JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

AND

MECHANICS' REGISTER.

JANUARY, 1841.

Address to the Subscribers to the Journal of the Franklin Institute, and to the Public generally.

The Committee on Publications of the Franklin Institute, have determined to commence a New Series of the Journal under their charge, with the beginning of the new year. The January number will, accordingly, be No. I of the Third Series of the Journal of the Franklin Institute.

This change they intend to connect with renewed efforts, as well in the intellectual matter as in the mechanical execution of the Journal.

The valuable papers of the late Chevalier de Gerstner and Mr. Klein, relating to the internal improvements of the United States, will be continued, and the Committee renew their solicitations to American Engineers to contribute the results of their practice to the valuable materials thus furnished to the American public by these distinguished foreigners. One of the most useful British journals contains numerous articles from the daily practice of engineers, which, though short, are interesting as well as valuable, results similar to which must be collected in every summer's work in the field. The Committee are indebted to Thomas U. Walter, Professor of Architecture in the Institute, for the promise of original and selected matter in his interesting department.

The deductions of the Committee on Water Power, from the elaborate series of experiments made by them, and already published in the Journal, will be furnished in this new series, the first part being prepared for the February number. The valuable abstract of patents, with remarks upon them by the Editor, Doctor Thomas P. Jones, will

be continued, as well as the publication of such specifications as appear to merit being given without abridgment. The Committee will endeavour, at the earliest possible date, to procure such notices of the various manufacturing establishments, machine shops, &c. of Philadelphia, as may serve to give an idea of the state of industry in the city, without bringing individual interests into conflict, and would invite the contribution of similar notices from other parts of the Union. They again urge mechanics to contribute practical matters to the journal, and thus to render their knowledge conducive to the general progress of the arts in which they are interested. Besides the view given of the progress of mechanical science by original articles and selections from journals at home and abroad, the Committee are promised notices and abstracts, exhibiting this progress in a more condensed form, by John C. Cresson, Professor of Mechanics of the Institute.

Original articles in chemical and physical science, will, as heretofore, be sought for. As an instructive mode of presenting the condition of particular branches, original essays upon them will be published, and their progress will be recorded by abstracts of the more important investigations in them. The department of general and practical chemistry will be under the charge of Dr. John Griscom, James C. Booth, Professor of chemistry applied to the arts, in the Institute, and John F. Frazer, Professor of general chemistry in the Institute. Translations of interesting articles from the French and German, will be made by Dr. Griscom and Professor Booth. The notices of physical science including astronomy, will be furnished by Professor A. D. Bache, and Sears C. Walker, Esq. The Committee have already incurred a debt to the last named gentleman of obligation for furnishing, in conjunction with Professor Kendall of the Philadelphia High School, the calculations of occultations for several years past. These will still be furnished by the care of these gentlemen from their own calculations or those of Mr. Downes, of Worcester, Mass., whom the Committee are gratified to add to the number of their correspondents.

To improve the mechanical execution of the journal, an entire new fount of type has been provided, by arrangement with the enterprising printer, Mr. Jesper Harding.

These improved arrangements entitle the Committee to ask, from the public generally, and especially from mechanics, an extension of the patronage heretofore given to the journal. The addition of one hundred subscribers to the present list would enable them to support entirely the expenses of the journal, which have heretofore been borne by the Franklin Institute at a small annual loss. Two hundred addi-

tional subscribers would enable them to reduce the price of the journal, which they pledge themselves to do in the event of such an increase to the present list. The object of the Franklin Institute in establishing the journal, was to diffuse knowledge, and not to reap pecuniary profit, and in that spirit the past and present arrangements have been made.

A liberal compensation will be paid, as heretofore, for articles accepted for publication in the journal.

The journal will, in future, be published on the first of every month, the delay in the first number of the new series is unavoidably connected with the arrangements already referred to.

JOHN C. CRESSON,
ISAAC HAYS,
SAMUEL V. MERRICK,
ALEX. DALLAS BACHE,
MATTHIAS W. BALDWIN,
ISAAC P. MORRIS,
} Committee on Publication.

Hall of the Franklin Institute of the state of Pennsylvania, for the promotion of the Mechanic Arts.
December, 1840.

Civil Engineering.

Letters from the United States of North America on Internal Improvements, Steam Navigation, Banking, &c., written by FRANCIS ANTHONY CHEVALIER DE GERSTNER, *during his sojourn in the United States, in* 1839.

(Translated from the German, by L. KLEIN, Civil Engineer.)

(Continued from Vol. XXVI., page 363.)

LETTER VII.

Louisville, Kentucky, June 5, 1839.

The Banking System in the United States.

The Banks have acquired such an extension and importance in the United States, and they are so intimately connected with every thing here, that no day passes without their being an object of conversation in almost every circle, and without observations being made about them in the public press, or Reports of Banks appearing in the papers. One would imagine, that the United States could not exist without banks or without credit, and if you ask, how so many populous, well-built towns have been erected in such a short period; how the im-

penetrable forests in the West have been cleared and cultivated; how the swampy lands on the Mississippi have been transformed into the finest sugar and cotton plantations; how, finally, this general prosperity, which is everywhere visible, has been produced in such a few years; the answer is, "we derive all this from our banking, our credit system; because credit is the first element of the welfare of the Union!"

I once visited a car builder in Philadelphia, who is pretty well known for his ability, but until now did not acquire any property, on account of his expending too much in constantly making experiments for improvements in the construction of rail road cars.

"Are you able to take a large order for rail road cars?" I asked the man. "Yes," replied he," "I can take an order to the amount of $20,000 and more, and require the payment to be made only at the delivery of the cars, in bills at six months." "But how are you able to accomplish this, without being in possession of capital?" "Nothing easier than that. After having made my contract with you, I go to a large timber yard and select what I want in lumber and boards; the timber merchant, on seeing my contract, gives me credit for at least eight months, during which time I fulfil my order. In the same manner, I get the iron, leather, brass, and whatever I want, also on a credit of eight months. I further want cash, to pay my workmen every week, to obtain which, I sell my note, which I get endorsed by one or two friends, to some bank; in this manner I go on with my work, and when I am paid at the delivery of the cars, in bills at six months, I settle my accounts with the lumber merchant and the other individuals, and pay them with the bills I have received. The lumber merchant himself, continued the car builder, has not paid for the whole of his stock; he obtained the timber from the proprietors of forests in the interior, who obtained advances from the banks, when they commenced cutting the timber; it is the same with the iron merchant and all others, who give me credit; they sell me articles which they have not yet paid for themselves, and the first producers have already obtained on their account considerable advances from the banks. This is the course every business takes here; we undertake every thing on credit; whoever has learned a business, and is active and honest, finds credit and money to accomplish every reasonable enterprise. It sometimes happens, that the speculation fails, and the speculator in consequence; he then settles with his creditors, pays them what is left, and commences anew. There are men who have failed four or five times in their lifetime, always recommenced, and again found credit, because they were known to be active and honest; some of them acquire at the end of their life, a considerable property, while others remain poor. The banks and other creditors

easily sustain single losses of this kind, because the mass of their business is so great, that in the whole, they always realize great profits. Thus we proceed in the new world; in the old world, they say, every hing is established upon a solid, durable foundation, and therefore an able and active young man finds no support, if he is deprived of capital; therefore so few undertakings are brought to maturity, as only such, which promise a secure and certain success, are taken up; but experience has shown there, that with all these precautions, they are sometimes found to have made a wrong calculation, and as at the same time the mass of business is proportionally so much smaller, the profits of individuals must be considerably less in the old world, than with us, and the general prosperity of the country must be far less on the increase than in the new world, under an active, industrious, and unprejudiced population, giving each other a mutual support." Such were the words of the car builder; six months have since elapsed; I have almost daily recalled to myself his words, and daily I found new proof of their truth. But the American credit system is such an enormous structure, it is so differently practiced in the twenty-six sovereign States of the Union, and like every other good thing, so much misuse has been made of it, that much time, conversation with well instructed individuals, and mature reflection are required, justly to comprehend the system in its principles, and to judge, how far the same would be practicable for our European institutions. It is the same with this as with the rail road system, the Americans have, in the course of ten years, completed 3000 miles of rail roads, and are always making new alterations and improvements; they have, in the last twenty-five years, established over 700 banks, and in almost every one of them have made some new experiments and amendments. There is no plan of construction of rail roads, there is no system of banking, that has not been tried here, and as the reports of most of the banks as well as of the rail roads, are published annually, we may find here, in regard to banking, instruction not to be obtained in any other part of the globe.

I have had occasion to speak in my last two letters of some banking institutions in the States of Georgia and Louisiana; this letter will contain a short history and description of the American banking system in general, and in my future letters I shall give a more detailed account of the establishment and management of Banks in the different States of the Union.

National Bank, or Bank of the United States.

The Americans had already, while they were English colonists, several banks; but after having made themselves independent of the

English sovereignty, they became more enterprising, wanted more credit, and therefore increased the number of their banks. Every State of the Union granted, at its discretion, bank charters, by which incorporated companies became authorised to issue notes and transact all business connected with banking, within the precincts of the respective States. They soon felt, however, that to obtain an uniform circulating medium, a common central institution was required, and they established in the year 1791, a national bank, called "The Bank of the United States," for which the charter was granted by Congress, and which was therefore recognised throughout the whole Union. The capital of this bank was $10,000,000, of which the general government paid in one-fifth; the term of the charter was twenty years. As most of the banks in the different States (State banks,) had only a capital of some few hundred thousand dollars, the bank of the United States not only did the largest business, but soon acquired a control over all State banks; as soon, namely, as any of these banks brought into circulation too great an amount of notes, or entered into unsafe speculation, the national bank refused its credit, and either did not accept the notes of that institution or sent them to be redeemed in specie. The national bank thereby obtained a powerful influence upon the money matters of the Union, a general complaint about its monopoly arose, and after the expiration of the term of its charter in the year 1811, the latter was not renewed.

In the year 1812 the war commenced between the United States and England; as a natural consequence, credit and enterprise declined, the public rushed to the banks to convert their notes into specie, and the banks were compelled to suspend specie payments. When peace was re-established, in the year 1815, the Union contained over 200 banks, whose notes were, according to the credit of the different institutions, taken at a discount of from 20 to 50 per cent., a great number of private individuals, at the same time, had emitted small notes or obligations, which circulated in the neighbourhood; the whole country was inundated with paper money—gold and silver had entirely disappeared. A plan for a national bank was presented to Congress by Alexander James Dallas, then Secretary of the Treasury, and after a long deliberation in that body, a law was passed in the year 1816, incorporating the second bank of the United States with a charter for twenty years; the capital of this bank was $35,000,000, paid in 350,000 shares, at $100 each, to which the general government again contributed the fifth part. The bank was administered by twenty-five Directors, five of whom were appointed by the federal government; the Directors elected from amongst themselves a President, the latter had a salary, but not the Directors. The principal bank was in Phi-

ladelphia, and twenty-five branch banks were located in the most important commercial places of the Union. The bank had great confidence and credit with the first merchants and bankers in England and France, and was conducted with an ability, which was acknowledged by every one, whether a friend or enemy to the institution.

The federal government employed this bank to receive from the collectors the revenues from duties and from lands sold at the different points of the country; to keep the sums in custody until wanted, and to pay the money out again, wherever it was required; the bank paid all pensions arising from the Revolutionary and late wars, the capital and interest of the national debt; and after the latter was extinguished, had always several millions of dollars of the surplus revenue on deposit. The bank paid no interest to the federal government on the sums confided to her, but at the same time made all the payments required at the different points of the Union, without charging anything for commission. The general government lost in this way the interest on its uninvested revenue, but spared a whole army of treasury officers, saved the cost of transportation, which was considerable twenty years ago, from the want of internal improvements, and finally, as long as it availed itself of the national bank, the general government had not to complain of a single loss, however small.

The confidence of private individuals in this institution was not less; whoever had uninvested capital, deposited the same in the mother bank or one of its twenty-five branches, an account was opened for him, and the bank paid his checks at sight. This was found so convenient, that by and by all capitalists gave to the national bank or one of its branches, or else to another bank, their bills for disbursement, and had all their payments made through the same. The bank did not take any commission for these transactions, but paid no interest on the money deposited. In this manner individuals dispensed with the trouble of exchanging money, which is no easy matter with the mass of different bank notes existing, many of which are often below par; they were relieved of the trouble of making their payments themselves, and finally were not in danger of losing money by thefts or otherwise. Merchants and others find it convenient to continue this course now, and you seldom find, in a counting house or private lodging, $50 in cash, as all the money goes through the hands of the banks.

According to its charter the National Bank could lend to the Federal Government at the most $500,000, and to the governments of the different states only $50,000. The bank issued notes which were received throughout the whole Union by individuals and public officers at par with specie, but were also immediately redeemed in gold or sil-

ver on presentation. The notes of the smallest denomination were of five dollars. The bank discounted bills with two endorsements, payable not later than four months, made advances upon state bonds and other public papers, and purchased and sold gold and silver; according to the charter the bank could not buy and sell public funds, and might possess only such real estate as was mortgaged to them and forfeited in consequence of non-payment. The rate of discount was fixed at 6 per cent. per annum, and as the bank constantly had a large amount of money in its vaults, the dividends on the bank shares usually were only 7 per cent.

The National Bank, which, as above stated, was founded for the second time in the year 1816, commenced business on the 1st of January, 1817, and as early as the 20th of February of the same year, the state banks in the large cities resumed specie payment. Those banks, which could not resume, lost all their credit and had to wind up their affairs. In the year 1819 perfect order was again re-established, and the National Bank had the control over all the state banks. For the second time the cry of monopoly was raised, and when the President of the United States, General Jackson, began to look upon the National Bank as a foreign power in the state, which he could not reconcile with his democratic views, he not only withdrew from the bank, in the year 1834, the moneys deposited by the Federal Government, but also vetoed the bill passed by Congress for the renewal of the bank charter. The bank after having paid over the deposits of the Federal Government, curtailed the discounts, diminished its business operations, and the country was seen to approach a new commercial crisis. After the expiration of the charter of the United States Bank, on the 3d of March, 1836, the banks in the different states recommenced expanding to excess, and a general crisis followed, from which the country is still not quite recovered.

The stockholders of the late National Bank were offered a charter by the State of Pennsylvania, and accepted from that state on the 18th of February, 1836, an act conferring banking privileges for thirty years, under the following provisions: the State of Pennsylvania was to receive as bonus $2,500,000 immediately, and besides, during twenty years, annually $100,000; the bank was to subscribe $675,000 for canals, railroads, and turnpikes; and is finally bound to lend to the state $6,000,000 upon state bonds, bearing 4 per cent. interest, to be taken at par, or upon bonds, bearing 5 per cent. interest, to be taken at 10 per cent. premium. Notwithstanding these heavy conditions, the bank, with a capital of $35,000,000, is very prosperous; and although its notes have legal value only in Pennsylvania, they are accepted in all the other states and often with a premium of one or more per cent.

Banks of the different States.

Bank charters are granted in most of the states of the Union with great liberality; in some of them without further indemnifications, in others for a certain bonus or part of the profit, and generally for a term of from twenty to twenty-five years. The issue of bank notes, and their proportion to the specie is generally left to the discretion of the banks. Most of the banks have a great number of shareholders; there are, however, a few cases, where banks were established by a few individuals. Generally, the legislatures preserve to themselves the right to enquire into the condition of the banks from time to time by commissioners appointed for this purpose; and the banks have to make reports periodically. The President, Cashier, and inferior officers have always salaries, the directors none: a general meeting of the stockholders is held annually, when a report is read to them, and they are made acquainted with the amount of dividends declared by the directors; at this meeting the stockholders elect a new board of directors, and in this manner may exclude from the administration single members or the whole board if they think proper. Such of the banks as appear the most secure are chosen by the Federal Government or the State Governments to receive their deposits and make the payments, as was formerly done by the National Bank.

With this diversity in the banking system, the most diverse results must be presented to us, and as the president and directors of the banks always seek to make the largest possible dividends, it is evident that they embark in a number of speculations, which ought not to be undertaken after mature reflection. Some of the banks possess specie to the amount of 50 per cent. of their issued notes, and therefore readily redeem all the notes presented to them, in gold or silver; other banks have issued three and even twenty times as many notes as the amount of specie in their vaults; whenever a new business offered itself new notes were issued, and when the time of payment came, individuals made new debts; such has been the state of affairs since March, 1836, when the National Bank was discontinued. It became with the banks the same as with the members of a new free colony, where every body is left to himself and may act at his own impulses; disorder and finally anarchy must be the natural consequences. On the 3d of March, 1836, the National Bank, until that time the head of the monied institutions of the Union, was discontinued, and already on the 10th of May, 1837, all the banks in the city of New York by mutual agreement stopped payments in gold and silver; a few weeks after, the other banks in the Union had to follow the same course, and it was not until the latter part of 1838 that specie payment was again resumed. The contest, about the establishment of a National Bank

for the third time, still continues, and has occupied Congress in its last session. The Democratic party, as it is styled here, appeals to the farmers and mechanics, as the most numerous part of the population of the United States, and reminds them of the losses they sustained by the frequent bank failures and suspensions of specie payments, while the opposite, or Whig party, repeats to the same farmers and mechanics, that the banks advanced the money for the purchase and improvements of the lands, which otherwise would have remained profitless; that the enterprising working man obtains money from the banks or credit from the merchant; that finally, the mason, the carpenter and every other mechanic owe it to the credit system, that their wages rose to two and three dollars per day; that, therefore, the banks, numerous and extensive, are indispensable to the welfare of the Union, and a National Bank of the highest importance to the same. The coming Presidential election will decide which of the two parties will obtain the victory.

Number and operations of the Banks in the United States.

To give a clearer view of the extent and operations of the banks in this country, I communicate an extract from two reports, made to Congress by the Secretary of the Treasury, one on the 8th of January, and the other on the 7th of June, 1838.

Date.	No. of banks without branches.	Banking capital.	Amount of deposits.	Notes in circulation.	Amount of loans and discounts.	Specie on hand.
		Dollars.	Dollars.	Dollars.	Dollars.	Dollars.
1st. Jan., 1811	89	52,601,601		28,100,000		15,400,000
Do. 1815	208	82,259,590		45,500,000		17,000,000
Do. 1816	246	89,822,422		68,000,000		19,000,000
Do. 1820	308	137,110,611	35,950,470	44,863,344		19,820,240
Do. 1830	330	145,192,268	55,559,928	61,323,898	200,451,214	22,114,917
Do. 1834	506	200,005,944	75,666,986	94.839,570	324,119,499	
Do. 1835	558	231,250,337	83,081,365	103,692,495	365,163,834	43,937,625
Do. 1836	567	251,875,292	115,104,440	140,301,038	457,506,080	40,019,594
Do. 1837	634	290,772,091	127,397,185	149,185,890	525,115,702	37,915,340
Do. 1838	675	317,636,778	84,691,184	116,138,910	485,631,867	35,184,112

Since the 1st of January, 1838, the number of banks has again increased, and their capital may now amount to not less than three hundred and fifty millions of dollars.

What an immense difference between this enormous capital and the insignificent one, which the few banks upon the continent of Europe, and especially in Germany, are in possession of. The Austrian Empire has now 34,000,000 of industrious inhabitants, and shall a single bank suffice for this immense country from the frontier of Russia down

to Dalmatia? Shall a single bank animate its commerce, make its industry and manufactures prosper, and elevate its agriculture? How much good could be effected, how much could the prosperity of the empire be increased, if at present, when the charter of the bank* expires, a separate bank were established at least in each of the provinces comprising that large Empire, headed by a great National, or Central Bank, and if their statutes were founded upon the extensive experience hitherto made in banking in Europe and in America.

To be continued.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Architecture.

A taste for architecture is not only an evidence of refinement and mental cultivation, but it affords a prolific source of enjoyment; a knowledge of the arts is one of the most desirable accomplishments of life.

Architectural objects are constantly before us whichever way we turn, and new buildings are continually springing into existence in every part of the country. Hence, if a taste for this useful, as well as polite, art, was generally cultivated, its beneficial influences would be co-extensive with the objects it creates, and all the buildings required for the comforts and conveniences of life would consitute so many sources of enjoyment; while at the same time they would embellish the country, elevate the standard of civilization, and throw an imperishable lustre around the national character.

In view, therefore, of the good to be derived from a diffusion of knowledge in architecture, some allusion will be made to this important subject in each succeeding number of the Journal, and such articles will be selected from time to time from the pages of other publications as may tend to promote so desirable an object.

Porticoes.—The similarity which exists in modern adaptations of columnar architecture is as adverse to the spirit of classic art as it is tiresome and monotonous in its effect. A portico is now considered almost indispensable to a design, and the orthodoxy of architects in matters of taste seems to be estimated wholly by the accuracy with which *orders*, and even whole *temples* are copied from the antique.

We often find laboured imitations of the Parthenon, the Theseum, the Erechtheum, and other relics of Grecian genius, executed in situations which not only degrade the beautiful originals, but betray a deplorable want of taste even in adaptation; and yet these "classic models," no matter how absurd their application may be, are tolerated and even justified, on the ground of "*authority.*"

* The National Bank at Vienna.

The popular idea that to design a building in Grecian taste is nothing more than to copy a Grecian building, is altogether erroneous;—even the Greeks themselves never made two buildings alike, nor had they any fixed rules for proportioning the details of either of their orders,—they observed a uniformity of principle,—a correspondence of expression; but always without imposing any fetters on genius other than the limits that nature herself has drawn.

A portico may therefore be designed in Greek taste without being exactly like any thing that ever existed in Greece; it may possess the spirit and beauty of Grecian compositions and yet be different in its disposition, as well as in its details.

If architects would oftener aim to *think* as the Greeks thought, than to *do* as the Greeks did, our columnar architecture would possess a higher degree of originality, and its character and expression would gradually become conformed to the local circumstances of the country, and the republican spirit of its institutions. T. U. W.

Franklin Institute.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Unalterable Blanks.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination Unalterable Blanks, made by Benners & Dainty, of Philadelphia, Penn.: Report,

That, the basis of the ink employed is of such a nature that the ordinary bleaching agents, employed to remove writing made on them with ordinary ink, will at the same time remove the basis on which the writing occurs, thereby rendering it difficult or almost impossible to remove or alter the amounts specified without so altering the basis as to destroy or change it in such a manner that the fraud may be detected.

The principle of the method is not novel, but it appears that the basis of the ink they employ is more easily effaced than that of ordinary checks. It should be observed that the above remarks refer to writing made with ordinary ink, and that the blue ink may be effaced without materially affecting the basis written on.

By order of the Committee.

William Hamilton, Actuary.

Philadelphia, Dec. 10, 1840.

Report on an "Improvement in the Apparatus for generating Steam."

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an "Improvement in the apparatus for generating Steam," by PHINEAS BENNET, of New York, present the following REPORT IN PART—

The first essential part of Mr. Bennet's plan is the employment of a close or air-tight furnace, within which the combustion of the fuel is effected. For this purpose, the air which feeds the fire is introduced into it through tubes, under a great degree of pressure, by means of blowing-cylinders or other competent apparatus, worked by the power of the engine; a part of the air entering below the grate-bars so as to pass through the fuel, and a part entering near the upper surface of the fire so as to cause the entire combustion of the smoke. The ash-pit is made close, but may be temporarily opened, by a valve or cock, to remove the ashes. The fuel (which is oak or hickory wood) is introduced through a vertical iron cylinder over the furnace, which has two steam-tight partitions sliding across it, so as to include a chamber between them. When the upper slide alone is opened, the fuel can be introduced into the chamber; and, when this is closed and the lower slide opened, the fuel falls into the fire, which is thus fed, without an opening into the external air.

The close cylinder in which the fire is thus maintained is surrounded by the boiler, whether it be vertical or horizontal, and is always enveloped by water. The gaseous products of the combustion pass from the fire-chamber through a cylindrical collar, or pipe, at the top, which rises through the water into the steam. Over this collar is suspended an inverted cylindrical box, the edges of which enter to a small depth into the water—the whole arrangement constituting what is called a cap-valve. In this way, the heated gases from the fire pass partially through the water, and assist in the generation of the steam.

The steam and gases now pass together into the cylinder of the engine, and operate conjointly upon the piston by their elastic power.

In this brief description many details are necessarily omitted—such as the arrangement for kindling the fire, &c., but it includes all that may be considered characteristic of the apparatus.

Three questions now present themselves for the consideration of the committee. The first has regard to the originality of the plan, the second to its efficiency, the third to the true principles on which it operates.

As to the originality of the plan, the committee are constrained to say, that the claims are very slender.

In a work entitled "The Abortion of the Young Engineer's Guide," published in Philadelphia in 1805, our ingenious and celebrated countryman, *Oliver Evans*, describes, under the name of "The Volcanic Steam Engine," what must be considered as the first conception of all the instruments of this class. The book is now so rare, and the description so full of interest, that the committee deem it proper to copy the whole article on the subject, which is as follows:—"In our pursuit of means to prevent the loss of the heat which is carried up the chimney of the furnace, let us have recourse to the works of nature. View the natural volcanoes, where the fire burns without the aid of atmospheric air; where all the elastic fluid generated by the fire dissolving the fuel, and all the steam formed by the water that may occasionally come in contact with the fire, united, form the most terrible and powerful of all steam engines; in which the furnace, boiler, and working cylinder are united in one, working on the simple principle of applying great elastic power; casting up mountains, and making the earth quake, as she brings her strokes. To apply these principles as far as we can, we make a cylindric boiler, about thirty-six inches diameter, eight or ten feet high, with a furnace inside of it eighteen or nineteen inches diameter. Both the boiler and furnace are united to the same heads, the fire being inside of the water, and the smoke flue turned downwards through the water to the bottom, where the smoke is vented and rises in many streams of small bubbles, that it may impart all its heat to the water to generate steam. The elastic fluid generated by the combustion of the fuel, which we may suppose is two thousand times the bulk of the fuel, and the air used to kindle the fire, expanded by the heat to double its original bulk, unite with the increased quantity of steam to work the engine with great elastic power. But until we can discover a fuel that will burn without the aid of atmospheric air, or until we can find means for kindling the fire with a blast of highly rarified steam, as may be the case in volcanoes, we use a forcing air-pump to force in air to kindle the fire. This form of engine will work with much less fuel, and be much lighter, than any other. It would therefore be more suitable for boats or land carriages, &c. I made a small boiler on this principle, which operated favourably; but being weary of the trouble and expense of putting new principles into practice, I declined the pursuit, until better prospects open, or a more favourable opportunity offers."

In 1824, and subsequently in 1828, *Mr. Samuel Hall* took out a patent in England, for a scheme, (figured and described in volume xii. of the London Mechanics' Magazine,) which agrees with Mr. Bennet's, in using a close furnace, in urging the fire by an artificial blast, in surrounding the fire-chamber by the boiler, and in conveying

the steam and the gaseous products of the combustion, together, into the cylinder of the engine. This inventor, however, did not pass the gas through the water, and, for some motive, caused part of the steam to pass through the fire. He also made use of two furnaces and two boilers, in order that "while one was being replenished with fuel, the other might, at the same time, be employed in the generation of vapour."

In the Mechanics' Magazine, for December 1829, *Mr. William Gilman* gives a description of an apparatus, illustrated by figures, which may be considered a modification of Hall's, but which much more closely resembles that of Mr. Bennet. A single close furnace is used, surrounded by the boiler; the fire is urged by a blast introduced both below and above the fuel; a regular supply of fuel is dropped in from the top; the gases from the combustion are made to pass through the water so as to aid in generating the steam; and lastly, the steam and hot gases pass together into the cylinder of the engine. The identity of this apparatus with that of Mr. Bennet is therefore perfect as to principle; nor is there any material difference in the mechanical arrangements. Mr. Gilman does not, indeed, describe his method of supplying the fire with fuel, and the contrivance used by Mr. Bennet forms one of the claims in his patent. But *Lord Cochran and Mr. Galloway* took out a patent, in 1818, for a steam engine, in which an air-tight furnace urged by a blast was used, and where the method of supplying fuel to the fire was the same as that adopted by Mr. Bennet, except as to the kind of movable partitions employed—a point admitting of great variety. The only real peculiarity in Mr. Bennet's arrangement seems to consist in the cap-valve, to which he lays special claim. It cannot be supposed, however, that an ingenious mechanic would meet with much difficulty in substituting for it some other valve equally advantageous.

While the committee thus fulfil their duty in presenting the whole truth as to the defect of originality in Mr. Bennet's plan, it gives them pleasure to state that he appears to have a just claim to the merit of being the first to carry this plan into successful operation. If Hall's engine was ever tried, its being abandoned shows that it must have failed. The correspondence in the Mechanics' Magazine, on the subject of Gilman's plan, renders it highly probable that his engine was never constructed at all, notwithstanding his assertions to the contrary. If then this novel arrangement possesses the advantages which are claimed for it, the community is indebted for them to the enterprise, perseverance, and skill of Mr. Bennet.

An opportunity of seeing the new engine in operation has not yet been given to the committee, but is promised by the gentleman interest-

ed in the project. When this personal examination shall be made, the committee will complete their report, so as to include the remaining points presented for their inquiry. The evidences given as to the saving of fuel in Mr. Bennet's engine are of the most extraordinary character, and make it a matter of public interest that the facts should be exhibited to an impartial tribunal.

By order of the Board.

WILLIAM HAMILTON, Actuary.

Philadelphia, Oct. 1st, 1840.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1839.

With Remarks and Exemplifications by the Editor.

1. For a Wooden or Frame Bridge, denominated *The Suspension Bridge;* Stephen H. Long, Col. U. S. E., November 7.
(See specification, vol. xxiv. p. 325, 2nd series.)

2. For a Wooden or Frame Bridge, denominated *The Brace Bridge;* Stephen H. Long, Col. U. S. E., November 7.
(See specification, vol. xxiv. p. 328, 2nd series.)

3. For improvements in *Coaches, and other Carriages;* Thomas Shriver, Cumberland, Allegheny county, Maryland, November 7.

There is too much complexity in the apparatus described in the specification of this patent, to admit of verbal description, the drawings contain twenty-two separate figures, and some of them with numerous references. The following are the claims.

"*First.* The extension of the perches beyond the jack bars and axles. The mode of staying the jacks outside, in vehicles of every description on rail roads, or common roads, in the manner herein described, or in any other substantially the same. The mode of supporting the tongue by a slider, or sway bar, in front of the axle tree. The plan of bending the side perches inwards, better adapted for light vehicles on roads, &c.; and the mode of stocking the axle trees, and arching them upwards, as described. I also claim the brake acting against the road; or if a rail road against the horse path, or rails, by means of the above, or any other mode substantially the same, and the window-bearing, turning on its centre, whether circular, or other shape, operating as herein described, or in any other manner substantially the same."

4. For *Blue Writing Fluid;* Henry King, city of Baltimore, Maryland, November 9.
(See specification.)

5. For *Coupling Two or More Ploughs;* to be worked by one team; Joseph Card, Painsville, and Grandison Newell, Mentor, Geauga county, Ohio, November 9.

"The nature of our invention consists in attaching to the draught end of the plough beam, a coupling case of such length as is desired, according to the number of ploughs to be worked at once, and so constructed as that each plough shall run truly, steadily, and at any given distance from its fellow."

The claim is to "the mode of drawing one, and of coupling two or more ploughs together, by means of the case, stirrups, and bolts, as described."

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6. For a *Bee House, or Hive;* John Schole, city of New York, November 9.

This Hive, or House, is very ingeniously contrived, so as to present the advantages sought for in a simple and economical manner. The outer case, or body of the hive, is an ordinary flour barrel, and within this there are placed a number of boxes, made of very thin pine boards, joined together in the rough, and in such form as to fill up the capacity of the barrel, and to be readily removed when full, and their places supplied by others. We shall not attempt a description of the manner of establishing the requisite communication between the respective parts, with the valves and other appendages, which are all arranged with a view to utility and economy. They have been long on sale in New York, and are now well known.

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7. For a *Road and Street Gauge;* Randal Fish, city of New York, November 9.

This is an apparatus intended to grade and gauge the surface of the ground in streets and roads, made, however, with a particular view to preparing streets for the reception of wooden blocks. It consists mainly of four pedestals to be placed two on each side, or on the side or middle of the road, and which support longitudinal or string pieces of board, which are attached to the pedestals, so that they may be adjusted to the required level, or inclination; and of a cross piece, the ends of which rest on the string pieces, whilst a gauge board descends from it, which may have its lower edge concave, so as to give the crowning form, in any required degree. By moving this along the string pieces, the grading may be perfectly regulated.

"What I claim is the manner in which I have arranged the three parts, as set forth, so as to adapt them by such combination and arrangement to the attainment of the end for which it is constructed. That is to say, I claim the combining of the side pieces, and the mode adjustable as set forth; with the grading gauge, and with the provisions for adjusting the same. It will be manifest that this instrument may be varied in some particular points, and yet remain substantially the same in its general structure and use; its essential features being its general capability of adjustment, as pointed out, so that by drawing

along that part denominated the grading gauge, its lower edge shall show the precise height, or line, of the surface of the road.

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8. For machinery for *Manufacturing Long Cordage;* William E. Meginnis, city of Philadelphia, November 9.

"The nature of my invention consists in a machine for manufacturing cordage by confining the strand, or rope, firmly in the end of the horizontal spindle that imparts the twist, and after twisting the rope, or a component part thereof, the length of the rope walk, the rope is loosened at the outer end of the spindle, and the operation of twisting is repeated. By this arrangement, ropes of great length, many times the length of the rope-walk, can be manufactured, and thus avoid splicing."

The claim is to "the making the head of the spindle in two parts, which can be separated for the purpose of putting in and taking out the rope, &c., or scarped out for the same purpose, as described."

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9. For an improved manufacture of *Cotton Twine, or Cord;* Jacob Sloat, Strasburg, Rockland county, New York, November 9.

(See specification.)

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10. For an instrument for *Measuring, for Cutting Garments;* John P. Barnett, and Francis Story, Cattskill, Greene county, New York, November 12.

This instrument, like many others for the same purpose, consists of elastic strips of metal, duly graduated into inches, and parts, and furnished with sliding and fixed strips carrying measuring tapes, by the use of which it appears likely that all the measurements required by the cutter can be correctly taken. The claims refer by letters to the respective parts supposed to be new.

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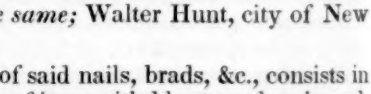
11. For an improvement in *Cut Nails and Brads, and in the Machinery for Manufacturing the same;* Walter Hunt, city of New York, November 12.

"The improvement in the form of said nails, brads, &c., consists in their being cut from hoops or plates of iron, with blunt, wedge shaped, points, and dove-tail, or wedge-shaped heads," as shown in the margin where *a* is a nail plate, and *b*, *b*, the nails. It will be seen that these nails do not require heading, they being cut with a projection on each side, forming what may be called a double brad head.



The cutting is effected by cutters, which are segments of cylinders made to vibrate on their axis; and so far as we can judge from the model, and from the nails and brads cut by the machine, its operation

appears to be perfect, whilst its construction and arrangement are such as to promise durability.

The claim is to "the making the two sides of the head of one nail out of the metal left by cutting the wedge-shaped points of the nails on each side as herein above described; and this I claim whether effected by the above described machine, or any other. Also in the machine above described I claim the shifting of the bed cutters for the purpose and in the manner set forth."

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12. For a *Cooking Stove;* Ebenezer Ferren, Haverhill, Grafton county, New Hampshire, November 12.

This stove appears to be well arranged for governing and directing the draught by means of dampers, and other devices connected therewith, the particulars of which it is not deemed necessary to set forth, and they could not be clearly described without the drawings. In its general form and construction this stove resembles numerous others, in common use.

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13. For a *Straw Cutter;* William A. Staples, Lynchburg, Campbell county, Virginia, November 16.

In this machine there are two knives, or cutters, placed upon the end of a horizontal shaft, which is made to revolve alongside the feeding trough containing the straw. These knives revolve between double rims or circular plates of metal which are sustained at a sufficient distance apart for that purpose. The claim is to "the employment of the double rims, between which the ends of the knife, or knives, are received and revolve, said rims being furnished with cross-bars, which operate as stationary, or bed, shears, sustaining the straw on each side as it is cut by the knife."

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14. For *Scales for Weighing;* George White, Louisville, Jefferson county, Kentucky, November 16.

These scales are to be combined with a counter, above which the dishes, or platforms, for containing the weights, and the articles to be weighed, are to stand; the parts which operate as a beam being within the counter. The claim is to "the method of adjusting the vertical support for the scales by means of the arrangement of the screws, nuts, and loops, as set forth; and the method of raising or lowering the fulcrum and beam so as to bring the scales close to the counter, and out of the way of creating any obstruction by the use of the same." In this arrangement there is not any thing worthy of special description.

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15. For a machine for *Turning the Heads of Wooden Screws and Rivets;* Henry Crum, Clarkstown, Rockland county, New York, November 16.

This machine is necessarily complex, requiring to have its respective parts fully exhibited by drawings, to make their action known. A principal feature of novelty in it is what is denominated the feed

wheel, which consists of a rim projecting out at right angles from a circular disk, or head. This rim is perforated to receive the shanks of the screws, which are fed in within the rim. The holes are countersunk to adapt them to the undersides of the screw heads, and these countersunks are formed in steel plates, and groved so as to constitute cutters. The shanks are received in a clamp chuck, on the end of a lathe spindle, or revolving mandrel, on the outside of the wheel; this spindle being forced back by a sway bar, causes the under side of the heads to be borne against the countersunk cutters; and at the same time a tool is brought up against the top of the screw head, and turns it. All the parts of the machine are self acting, with the exception of the putting the screws to be turned into the feed holes in the wheel, by hand. There are a number of ingenious devices about this machine, some of which resemble, very closely, those employed in that for cutting wood screws, invented and patented by the same gentleman.

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16. For an improvement in *Friction Matches;* John H. Stevens, city of New York, November 16.

The claim under this patent is to the preserving of the matches from accidental ignition by covering them with a coating of varnish, as set forth. Various substances, it is said, may be used for this purpose, but what is used in general "is a little solution of gum mastic, made with spirits of turpentine; or of an alcoholic solution of gum copal or of gum mastic; but other glutinous gums, resins, tenaceous matter, or compounds may be used," &c.

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17. For forming the ignitable matter of *Friction Matches;* John H. Stevens, city of New York, November 16.

The claim is to "the combination of litharge, and the red oxide of lead, or either of them separately, with carbonate of lead, phosphorus, and any glutinous or viscid material on which the preparations of lead will produce a drying effect, and thus render the said compound harder and more durable, retaining its specific character for a longer period than any other compound analogous thereto, and designed for the alike purposes of ignition, all as described."

"I also claim the combination of litharge and red lead, or either of them separately, with the black oxide of manganese, phosphorus, and a glutinous or viscid material on which the preparation of lead will produce a drying or hardening effect, substantially as described."

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18. For improvements in *Friction Matches;* John H. Stevens, city of New York, November 16.

"The nature of my invention consists in dispensing with sulphur, which is employed in the ordinary wood matches or friction lights, to make them more ignitable; and using in lieu of it, nitre or salt petre, by which means the match is not only ignited, but the unpleasant smell of the sulphur is avoided, while at the same time the match being

saturated with the nitre, is converted into a slow match, and continues to burn until consumed. The said matches I call Stevens' fusee segar lights."

The splints are to be soaked in a solution of salt petre, dried, and dipped into the phosphoric composition. The claim is to the combination of the wood so saturated and dried, with any of the suitable phosphoric compounds.

We should offer some animadversions upon the foregoing patents, but believe that the question of the validity of some of the claims is now a subject of legal investigation, and therefore we, at present, leave them to the proper tribunal.

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19. For a *Steam Boiler;* John C. F. Saloman, Shelbyville, Shelby county, Kentucky, November 16.

The patentee of the foregoing boiler obtained a patent on the 17th day of Oct., 1835, for an inverted arch steam boiler, which was, as we believe, constructed upon false principles, and in the *improved* form now given to his boiler, he has carried the same principles to a much greater extent. The plan would require only to be seen by any intelligent practical man to insure its unqualified condemnation. The claim will not lead to a knowledge of the arrangement of its respective parts, and it would waste too much time and paper were we to attempt a description of it. We wish for the sake of the inventor, who appeared to be a gentleman of much cleverness, that the patience and perseverance which he has displayed against numerous obstacles, had been directed to the attainment of some object of utility, and about which he knew something more of first principles. We will merely add, that he uses his inverted arch boiler, and to the junction of each of his arches he attaches a cylindrical boiler, extending from end to end of his main boiler. These are represented as nine in number, and we suppose are to operate as abutments to his arches; these form what the patentee calls a "*nine sided plane cylinder!*"

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20. For improvements in *Cooking Stoves with Elevated Ovens;* John P. Williston and Willard A. Arnold, Northampton, Hampshire county, Massachusetts, November 16.

In this specification there is described a manner of dividing the flue which leads from the fire chamber to the stove pipe, immediately under the top plate of the stove, into three separate flues furnished with dampers, or valves, "for the purpose of directing the draught under either or both of the upper boilers," but this mode of dividing the flues and directing the draught is not claimed, the claim being confined to the manner in which they have combined an elevated oven with a stove, by carrying the heated air compartment entirely across the back end of the stove and allowing the flues from the elevated oven to open into this compartment; by which means the perfect action of the oven is secured although the draught may be directed under one of the upper boilers only.

21. For an improved *Spark Arrester;* Leonard Phleger, city of Philadelphia, November 25.

This spark arrester has been superseded by one since invented by Mr. Phleger, who has, we believe, abandoned that which was the subject of the above named patent. We shall, therefore, let this go among the unsuccessful attempts to accomplish an important object; and should that now used by Mr. P. continue to sustain its present reputation, we will publish the specification, with drawings of the apparatus.

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22. For *Preventing the dragging of Ships' Anchors;* Russel Evarts, New Haven county, Connecticut, November 25.

"My machine consists of a weight of iron or other metal, called a sinker; the base being square, and the height about twice as great as the breadth of the base. In its top is a semi-circle to receive the chain or cable; near the top is a hole to receive a bolt which is to fasten a clasp to the sinker. There are also two rings below the bolt hole, and above the centre, of the sinker."

We were about to furnish the description given by the patentee, to a greater extent than the foregoing, but believe that we can render the construction much more clear by a few words of our own. The sinker is a heavy weight, furnished with a bale, or gallows, at its upper end, and containing a friction roller which is to rest on the chain, or cable, and guide it down near to the anchor. This bale is bolted to the sinker, and can be removed for the purpose of placing it upon the cable, when it is to be raised. The weight, laying upon the bottom, will tend to keep the anchor down, and prevent its dragging. It is proposed to use a similar apparatus to be allowed to descend half way to the anchor, so as to give a spring to the chain, or cable, which will tend to prevent its parting, from sudden jerks. The claim is to the construction and employment of the above described apparatus.

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23. For a *Cooking Stove;* Micah Ketchum and W. A. Wheeler, Boston, Massachusetts, November 25.

In this stove there is a box, or grate, within the fire chamber, which is to be raised or lowered by means of racks and pinions under the hearth, which, however, is not a novel feature in stoves; the claim made is very limited, being to a certain movable, dividing plate, in combination with a partition, which combination, not appearing to be of any special importance, we shall pass over.

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24. For machinery for *Boring the Posts and Tenoning the Rails for Fences;* William H. Shay, city of New York, November 25.

"For boring the posts I use two or more augers placed side by side, and geared together so that by communicating motion to one of them the whole will be made to revolve. The parts to be bored are held by means of what I denominate calliper leaves, which are sustained

upon a sliding carriage upon which the post can be fed up to the augers. The tenoning apparatus consists of cutters placed upon a revolving wheel which I denominate the rotary cutter, or tenoning wheel. Said wheel having a double rim, each of which is furnished with a cutter, or cutters, that sharpen, or tenon, the rails, reducing them all to the same thickness at the ends."

The claim made is to "the combination and employment in such a machine, of the calliper leaves for holding the posts whilst they are being bored; by means of which the range of mortars will all be in a direct line, and through the middle of the stuff, notwithstanding any twist, or other irregularity, which there may be in it."

Specifications of American Patents.

Specification of a Patent for a Blue Writing Fluid, granted to Henry King, *city of Baltimore, Maryland, November 9th,* 1839.

To all whom it may concern: Be it known that I, Henry King, of the city of Baltimore, in the state of Maryland, have invented a new and improved mode of manufacturing blue writing fluid; and I do hereby declare that the following is a full and exact description thereof.

To enable others skilled in the art to make and use my invention, I will proceed to describe its composition and operation.

1st. Take Indigo powdered, 2½ ounces.
" Sulphuric acid 1 lb.

Mix, and stir with a glass rod, occasionally, until the indigo is dissolved.

2d. Take next Galls, Aleppo 1 ounce.
" Alum . 3 dachms.
" Boiling Water 1 pint.

Mix, and let stand twenty-four hours or till the precipitate falls, then filter.

Take mixture first, put it in a glass, or stone, vessel, add sixteen ounces of water. Then gradually add carbonate of lime four pounds, or a sufficient quantity to neutralize the acid, then add seven pints of water, pour off and filter; then add mixture second, and to each ounce of the fluid add one grain of sulphate of iron.

To manufacture the changeable blue writing fluid: take one gallon of the blue fluid already prepared, and add to it No. 2, then to each ounce add nine grains of sulphate of iron, and filter.

What I claim as my invention, and desire to secure by letters patent, is the combination of the ingredients herein specified, so as to form a blue writing fluid, the same being combined in the manner set forth.

Henry King.

Specifications of English Patents.

Specification of a Patent granted to Goldsworthy Gurney, ***of the county of Cornwall, and*** Frederick Rixon, ***of the county of Middlesex, for their invention of improvements in the apparatus for producing and distributing light.***—[***Sealed 8th June,*** 1839.]

This invention of improvements in the apparatus for producing and distributing light, is applicable to lamps or burners, wherein oil or oleaginous matters, in a liquid state, are the materials consumed for producing the illumination; and our improvements also apply to various kinds of lamps, burners, or lights, wherein the inflammable gas or vapour obtained by the distillation of coal, oil, rosin, asphaltum, or other bituminous, resinous, or oleaginous matters is used, as the material for illumination; such gases or vapours being previously obtained, and then conveyed to the lamps or burners by pipes from a reservoir or gasometer; and consist, in the first place, in improved arrangements and constructions of conducting pipes or tubes and cocks, and jets or burners, whereby we are enabled to introduce into the interior of the flame of such lamps or burners, a stream or jet of pure oxygen gas. The atmosphere or atmospheric air being carefully excluded therefrom, that is, from passing through the burner, or into the interior of the flame. This jet or stream of pure oxygen is applied or given to the flame for the purpose of producing a more intense ignition of the carbonaceous matters, and consequently a more brilliant light than can be obtained where atmospheric air alone, or a mixture of atmospheric air and inflammable gases, are used to cause combustion.

It may be proper here to remark, that we are perfectly well aware that mixtures of air and inflammable gases have been applied to flame for the increased production of heat, and in certain cases to produce light, (in a peculiar description of lamp) which lamps burn the vapour or gas arising from the liquids contained within themselves; we therefore wish it to be distinctly understood, that our improvements have nothing whatever to do with such mixtures of atmospheric air and inflammable gases.

And we are also aware, that pure oxygen has been applied to hydrogen gas for the purpose of producing intense heat for blow-pipe purposes, and on lime for producing light; we therefore desire it to be understood, that our invention only applies to administering to the flames of oil or gas lamps, or burners, a jet or stream of pure oxygen, which, of itself, is not inflammable; but, when applied to the flame in the manner hereinafter described, and at the proper place, will produce intense or bright and clear light, which is caused by the oxygen or supporter coming into contact with the combustible bodies or inflammable gases, at the point of ignition. Therefore, as regards our invention, this jet or stream of pure oxygen may be called the source or cause of the extra light given out; and we have, therefore, in contra-distinction to all other lights, called this "The Olio-oxygen, or Bude Light."

And secondly, our improvements consist in the application and use of peculiar and novel constructions and arrangements of apparatus, whereby flashing or intermitting lights may be caused, or produced, and used as signals for locomotive steam-engines or carriages, and steam or other vessels, or in other situations where they may be required; such intermitting or flashing lights being caused or brought into operation by the passage of streams or bubbles of pure oxygen through flame, when brought in connection therewith, or of inflammable gases when burnt alone without the jet or stream of pure oxygen, such bubbles of inflammable gas being ignited by a small stationary and continuous light; the bubbles of gases being produced by their passing through an inverted syphon, containing liquid, acting as an hydraulic valve. Or the same effect may be caused by the actuating power of machinery or an engine, and may therefore be made capable of indicating the speed at which a locomotive engine or steam vessel is traveling, by the rapidity with which the flashes are repeated.

This effect may be produced by any proper arrangements of mechanism depending on the revolution of the wheels, or the strokes of the engines, or other moving part of the machinery; or in the former case by increasing or diminishing the column of liquid in the inverted syphon, and thus causing a greater or less resistance to the passage of the gas. The same effect may also be produced by altering the capacity of the gas and water tubes, and thereby causing a quicker or slower pulsation of the light.

The construction of the lamp requires two supply pipes—one of which may lead from the street main, or supply gas pipe, gasometer, or oil or gas reservoir, or other source, as the case may be, and the other is the pipe through which the pure oxygen or non-inflammable gas is to pass, or be conducted to the jet or burner,—this pipe may lead from any suitable apparatus for obtaining the pure oxygen, or from a reservoir containing that gas.

The oxygen pipe is connected by an air-tight joint to the lower part of the burner or jet, and passes up the interior thereof, its mouth or exit aperture being on a level, or a little below that of the burner or surrounding flame.

Both of the pipes where inflammable gas is used, must be furnished with stop-cocks, to cut off or supply the two distinct gases. These cocks may be placed separately on the pipes, or they may be constructed with one plug, serving for both pipes, they being connected by air-tight joints to the separate channels. The plug has two apertures bored through it, which are opposite, and answer to the separate channels. The bore of these apertures should be somewhat smaller than that of the passages to allow for wear in the parts, or tightening down the plug.

It is desirable that the apertures should be so arranged, that the oxygen may be let on a little before the inflammable gas, and also shut off a little after it. This is readily done by making the apertures for the inflammable gas, a little smaller than the other.

It is requisite, in order to carry this part of our improvements into proper effect, that the two streams or jets of inflammable gas, and pure

oxygen or supporter, should flow in proper proportions one to the other, therefore the pipes or channels, must be furnished with regulating cocks, or set screw plugs, by which their capacity, or the passage of the gases through them, shall be determined.

When oil, in the fluid state, is consumed for illumination, the pipe or tube, leading from the oil reservoir of the lamp to the circular channel within the burner, is made like a common Argand burner, excepting that the bottom part is closed, so that *no* atmospheric air can pass up the interior. The burner is furnished with a cotton wick, and means of adjusting its height, together with a gallery to hold a glass chimney, as usual. The pipe for the passage of the pure oxygen from the reservoir to the flame is passed through the side of the burner by an air-tight joint, and extends upwards within the burner. The oxygen pipe is furnished with a regulator, plug, or stop-cock, and also with the other cock for the purpose of giving the supply of oxygen to the lamp when it is once lighted, and cutting off the same when it is to be put out. A movable cup is screwed air-tight to the bottom of the burner, which serves for the purpose of stopping up the end of the middle channel, and receiving any deposit from the oil or flame.

The pipes, and the cutting off and supply cocks which, in this instance, have their plugs separate from one another, are turned simultaneously by one handle,—the end of one of the plugs being keyed or counter-sunk into a mortice in the other, so that they must move together, although they may be set up or tightened separately, as may be required.

The second part of our invention contains modifications of our improved apparatus for producing flashing or intermittent lights for signal purposes;—these figures will serve to explain this part of our invention.

There are two ways of obtaining or producing this effect; the *one* is by the *simple action* of bubbles or globules of gases passing through liquids; that is, of inflammable gas, when this alone is used to cause the light, and also of the pure oxygen when the flame of other matters is used in conjunction therewith, the bubbles of either the inflammable or non-inflammable gases passing from the supply pipe through an inverted syphon or chamber, containing a column of liquid, which, acting as an hydraulic valve, (the column being displaced before the bubble can pass,) interrupts the passage of the gases through the pipe, and produces pulsation at the burner. The *other* method is to obtain the same effect by mechanical means, by alternately exposing and hiding, or nearly shutting out the light. The effect of this mechanical operation may be obtained by placing a revolving or moving shade around the flame of the lamp, which shade shall hide the light, except at a part desired, say all but through an aperture in the side of the shade. This aperture being furnished with a reflector to throw the light to a distance, and as the shade and reflector revolve around the flame, it will have the appearance or effect of a flashing or intermitting light to any person placed before or behind it; or the same effect may be produced by alternately opening and shutting the door of a darkened lanthorn containing the light.

Another arrangement of mechanism for producing the same effect, is by means of a supply and cutting-off cock or valve, placed in the gas pipe when the inflammable gases are used alone, or the oxygen when used with the flame of other bodies; which cock is to be alternately opened and closed by some suitable connection with the machinery, and by thus alternately supplying to and cutting off the inflammable gas, or the oxygen, as the case may be, from the flame, produce a flashing, interrupted, or intermitting light.

When the inflammable gas is used for this purpose, there must be a small continuous flame in such position that the bubbles of inflammable gas, as they come in contact with it, will catch fire, and the flashing light thereby be produced; and when pure oxygen is used, the flame of the oil or other matters being kept continually alight, its intensity will be increased or diminished as the oxygen is supplied thereto or cut off therefrom.

One arrangement and construction of apparatus, whereby the method of causing the intermitting or flashing light, by interrupting the passage of the gas or oxygen from the reservoir to the burner or flame, is effected, by means of a column of fluid being placed in its way. A gas pipe is connected, air-tight, to the closed chamber or well containing a given quantity of water or oil; a pipe is carried down to near the bottom of the chamber, where its end is turned up, and opens into the inner tube, which serves as a guide for the bubbles as they arise, and determines the time of pulsation, or passage of the bubbles, by its area; or the same may be determined by the height of the column of fluid.

It will be evident, that if the pressure of gases in the reservoir is properly regulated according to the height of the column of water in the chamber, (or vice versa,) the gases will only be able to escape from the descending pipe through the chamber to the burner in bubbles, or only at intervals, or whenever the pressure of the gases has overcome the weight of the column of water, and forced it out of the descending pipe into the chamber, and thus allowing the escape of the gases to the burner only at intervals. There is a pipe, furnished with a funnel and stop-cock, by which liquid can be introduced into the chamber, and a pipe and cock whereby it can be withdrawn.

This interruption of the flow of the gases can be obtained by several other modifications of apparatus, wherein water or oil is opposed to the direct or continuous flow of the gases, the fluid having to be displaced by the force of the gas before it can pass,—the water or oil returning after each portion of gas has effected its escape; therefore it will not be necessary for us to describe all such modifications of the simple apparatus; but we will proceed to describe one or two modifications, or arrangements, or constructions of the mechanical means to be employed to produce this effect.

Another modification of apparatus, consists of a revolving shade or reflector, placed around the flame of the lamp, which will prevent the transmission of light, excepting through the face thereof; and as this reflector turns around the stationary light, it will throw the rays of light in different directions, and by being enclosed in a dark lan-

thorn, with only one face or part open, will have the appearance of an interrupted or flashing light to any person stationed before or behind it. The jet or burner, is fixed in any convenient situation, and is furnished with all the requisite pipes and tubes for oil or gases; a hood or reflector is fastened to the tube which surrounds the burner, and rests on a shoulder or ledge formed upon it. Rotary motion is to be given to this tube and reflector by any convenient mechanism connected with the machinery, as by a band passed from a pulley, or any rotary part of the engine or machinery.

The same effect of flashing or intermitting light, may be produced by alternately opening and closing a door or shutter in a dark lanthorn, enclosing the flame, and may be done by a suitable machine, having an alternate motion from any part of the machinery.

Another mode is to cause the intermitting or flashing to be produced in a stationary lanthorn and continuous light, but in which the supply cock of the oxygen pipe is alternately opened and closed, whereby the intensity of the flame is increased or diminished, as the admission of the oxygen is allowed to pass to, or is cut off from the flame.

An oil lamp, adapted for this purpose, may be furnished with a movable reservoir of oil and cotton wick burner in the ordinary manner, and a pipe or channel for the pure oxygen, leading from a reservoir to the top of the burner into the interior of the flame. The part of this pipe, between the lamp and the cock, may be made either of metal or flexible material, as circumstances may require. A supply and cutting-off cock or valve, in this instance, is intended to have a rotary or interrupted rotary motion given to it by means of the pulley on its plug; but a common slide-valve or cock, alternately opening and closing by means of a reciprocating or alternating motion, obtained from the machinery, may be placed in the same situation, and will produce the same effect. A lamp or lanthorn may be fixed in any required position, and when flexible tubes are used, may be made to take on and off its fittings when required. The seat or bed of the cock or valve is to be fixed in any convenient situation on the locomotive engine or vessel, and a rotary or alternating rotary motion given to it, by means of a band or strap passed to a pulley, from any revolving part of the machinery, or by a toothed rack connected with and actuated by any part of the machinery, which has a regular alternating or reciprocating motion; or the same effect may be produced by an eccentric, connected by a rod to a crank, all of which modifications or arrangements are so well understood, that it is not necessary for us to describe them.

Having now described and ascertained our improvements, and the manner of carrying the same into effect, we wish it to be understood, that we do not intend to confine ourselves to the precise forms, or arrangements of construction of apparatus or mechanism, herein shown, as the same may be varied to suit different circumstances; and we claim as our invention, secured to us by the above in part recited letters patent, as our "improvements in apparatus for producing and distributing light," first, the arrangement and construction of pipes or tubes connected with jets or burners, and furnished with suitable

stop-cocks or valves, whereby a jet or stream of pure oxygen is administered or given to the interior of the flame of either oil-wick or inflammable gas lamps; and, in the second place, we claim, as our improvements in apparatus for producing and distributing light, the improved arrangement and construction of apparatus or mechanism, whereby we are enabled to produce an intermitting, or interrupted, or flashing light, to be used as signal lights for railway, telegraphic, and navigation purposes, either by passing the inflammable gas in bubbles, when it is used in connection with a small fixed continuous light, or the pure oxygen when used in the interior of flame, obtained from the combustion of other matters, the pressure of the gas overcoming a column of fluid, and thereby causing pulsation or passing of bubbles, before it can escape to the burner or flame; and also the improved apparatus or mechanism, whereby we obtain the same effect of intercepting the passage of the gas, either inflammable or non-inflammable, to the fixed or continuous flame, by alternately opening and closing the valves, cocks, or taps of the gas pipes, and thereby causing an intermitting or interrupted light; and also the improved apparatus or mechanism, whereby we obtain the same effect, by the revolving or moving shade or reflector surrounding the light, as hereinbefore described.* Lond. Jour. Arts & Sci.

Specification of a Patent granted to JAMES HORNE, *of Clapham Common, Surrey, gentleman, for improvements in the Stuffing Boxes of Lift Pumps.*—[Sealed 3d September, 1839.]

The peculiarity of this invention consists in combining in each stuffing box two cupped leathers inverted, with their bases towards each other, and having between them a flat disc of metal; the flanch of the lower cupped leather rests upon a projecting ledge, cast upon the inside of the stuffing box, and that of the upper cup is forced down by a similar projection in the cup of the stuffing box, in such a manner that, on the rising of the piston rod (which passes through both the leathers, and the metallic disc,) the lower leather will resist the pressure of the fluid from below, and the upper leather that of the atmosphere from above, on the return of the piston rod. Mining Jour.

Specification of a Patent granted to THOMAS FARMER, *of Gunnersburg House, near Acton, Middlesex, for improvements in treating Pyrites and other matters, to obtain sulphur, sulphurous acid, and other products.*—[Sealed 25th August, 1839.]

This invention consists in treating pyrites or other substances containing sulphur in a state of combination, and by causing them to burn in a furnace without the aid of fuel, so as to disengage the sulphur which they contain, and form thereby sulphurous acid gas, or sulphur in its simple state. The furnace having been heated in the first instance

* Figures descriptive of the apparatus, are given in Newton's Journal and Repertory, for September 1840.

with coals, or with burning pyrites, is afterwards fed with pyrites introduced in the doorway; and the further advantage of this invention consists in the mode of charging the furnace, regulating the admission of the atmospheric air, and the withdrawing of the decomposed materials.

The furnace has two chambers, one above the other; the doorway of the upper one is in front, and the lower chamber has its doorway behind. The pyrites, with the fuel, is first placed in the upper chamber, and is lighted in the ordinary way, and whatever particles escape through the upper grating, the lower furnace will consume, which residuum is removed when required, and as soon as any pyrites in the upper furnace form into clinkers, such clinkers are removed, and fresh pyrites are thrown on to the burning fuel, which yields its sulphurous acid gas to be passed off through a chimney, or channel, into a chamber, where it is treated as sulphur heretofore.

When it is designed to treat for sulphur, rather than for sulphurous acid gas, the door must be closed entirely, and only sufficient air must be admitted through a vent, in order to support combustion; and to facilitate the sublimation of the sulphur, a vapour of water must be passed from the ashpit to the burning pyrites, which impart their sulphur to be condensed in the ordinary way adopted. Ibid.

Specification of a Patent granted to James Beaumont Neilson, *Glasgow, for certain improved methods of Coating Iron, under various circumstances, to prevent oxidation or corrosion, and for other purposes.*—[Sealed 29th August, 1839.]

The inventor claims the method of coating or covering iron, &c., by means of copper, or alloys of copper, with zinc or tin. The copper or alloy is brought to that minute state of division in which it is obtained by precipitation from its solution, or it may be used in a granulated state. In order to cover cast-iron, sprinkle a thin coating of granulated, or other fine copper or alloy over the surface of the mould, to which may be added borax, or other flux, to facilitate the spreading or diffusion of the metal. Thus, when the molten iron is poured into the mould, the copper or alloy will be fused, so as to cover the casting, and render it secure against oxidation or corrosion.

If malleable iron is to be coated, put a covering of the pulverised copper or alloy over the upper surface of the iron, while it is being heated, and the borax, or other flux, will soon cause it to spread over the heated part, which should be plunged into water, to detach the scale of oxide that forms upon it. Ibid.

Specification of a Patent granted to GERARD RALSTON, *merchant, Tokenhouse-yard, London, for improvements in Rolling Puddle Balls, or other masses of Iron, by employing a peculiar machine, for the purpose of compressing the iron into a state called bloom, preparatory to its being rolled into plates, or operated upon by tilt hammers.*—[Sealed 22d August, 1839.]

The machine consists of a rolling cylinder, revolving on an axle within a strong iron frame; a toothed wheel is attached to each end of the cylinder, which is acted upon by pinions, to give it the necessary rotary motion. A segmental piece of iron firmly fixed to the frame, embracing the cylinder, but in an eccentric position to the periphery of the cylinder; between this segmental piece of iron (which is semi-circular at the entrance) and the cylinder, the mass of iron passes in the form of a ball; a rotary motion being given to the cylinder, the mass of iron decreases in diameter, and increases in length, until it is delivered out at the bottom of the machine in the form of a roll.

The inventor claims, first, the entire machine.

Second, the mode of working the same in a horizontal position, if it should be found more convenient.

Third, by making masses of iron into balls, and then into rolls by one machine, either as the above or by substituting a piece of flat iron for the segmental piece, and having a second piece of iron wedge-shaped, working on an axle in conjunction with the flat piece, which might be made to produce the same effect. Ibid.

Specification of a Patent granted to JOHN WILSON, *Liverpool, lecturer on chemistry, for improvements in the manufacture of Carbonate of Soda.*—[Sealed 19th August, 1839.]

This improvement consists in using bicarbonate and sesquicarbonate of soda in preparing common carbonate of soda. The inventor obtains carbonate of soda from sulphuret of sodium, by adding one equivalent, or eighty-five parts of bicarbonate, to one equivalent, or forty-eight parts of sulphuret of sodium.

He also obtains carbonate of soda from the black ash usually produced by decomposing sulphate of soda, by adding bicarbonate of soda in relative proportions to the caustic and carbonate of soda contained in the black ash.

Claims the use of bicarbonate of soda, and sesquicarbonate of soda, in obtaining carbonate of soda from sulphuret of sodium, and also from the black ash obtained by decomposing sulphate of soda in the usual manner. Ibid.

On Bone and its Uses in the Arts. By A. AIKIN, *late Secretary of the Society of Arts, London.*

Most animal bodies are composed of soft and hard parts; of the latter, some are hard only when of a certain thickness, but when thin are tough and more or less flexible and elastic; such as the horns of all mammalia (except of the stag tribe;) the claws of the lion and tiger; the talons of the eagle; the horn of the rhinoceros; the coriaceous covering of tortoises and crocodiles; and the scales of fishes.

All these, by exposure to a gradually increasing heat, soften, enter into pasty fusion, give out the odour of burnt feathers, burn with jets of flame, and are consumed, leaving behind a very small proportion of earthy matter. 500 grains of horn leave not more than from 0.25 to 2 of phosphate of lime. Boiling-water, after long action, takes up from most of them scarcely any quantity of soluble matter, but they are perfectly soluble in caustic alkali, and the solution gives, with acids, a curdy precipitate. They are considered, therefore, as composed of condensed membrane, or, in chemical language, of albumen.

Other hard parts are rigid, considerably harder than the former; when dry, and in many cases when wet, they are very slightly flexible or elastic; and when struck by a hammer, or when bent beyond their power of resistance, break short with a splintery surface. When exposed to a red heat, with access of air, the membranous or animal part is destroyed; but the earthy part remains in sufficiently abundant quantity to retain the external form, and generally the internal structure, of the entire substance, of which calcined bone and calcined oyster-shell are examples. The original hardness of these parts is owing to the abundance of earthy matter that enters into their composition. When such parts are on the outside of the body, they are called, in common language, shells, horns, teeth, according to their position; and the uses for which they seem intended. When they occur within the body, they are called bones.

If, however, we restrict the term bone to its common meaning, we shall exclude the horns of the stag kind, and the substance which forms the body of most teeth, both which are truly bone, and shall include some substances, such as cuttle-fish bone, which is truly shell.

It is, therefore, necessary to enter into a more minute examination and comparison of these hard substances, in order to ascertain which of them are shell and which bone; and, as the result of our inquiry, we shall probably find, with respect to this class of natural bodies as with many others, that although the two extremes of the series are readily enough distinguishable from each other, yet they approach by such insensible intermediate gradations, as to render it impossible to say where the one begins and the other ends.

There is a class of shells comprising most of the univalves, which are harder than other shells, and when broken, present thick, parallel layers, the layers themselves having usually a finely fibrous structure

at right angles to the external surface. These fibres may often be seen to be nothing more than the transverse section of thin transparent parallel lamellæ, which, when viewed on their broad surfaces, often exhibit the usual natural joints of calcareous spar. When such a fracture is viewed by the naked eye, it has a good deal the appearance of porcelain,—whence their name of porcellanous shells. When carefully cleansed from all remains of the animal which inhabited them, they give out scarcely any perceptible odour on being made red hot, though their colour becomes somewhat grey. When unaltered they dissolve in dilute acid with much effervescence of carbonic acid gas, and a few hardly appreciable gelatinous flocks remain undissolved. These latter, on being collected and washed, give out, when heated, a faint odour of burnt animal matter, and become black before they are consumed. By proper chemical tests the soluble part of the shell is proved to have been carbonate of lime or chalk, the particles of which were cemented together with a very minute portion of animal mucus.

Another class of shells is the nacreous, so called from the varying and iridescent colours that they exhibit, resembling those of nacre, or mother-of-pearl; this very substance being, indeed, only a part of a nacreous shell.

These, when heated in a crucible, give out the odour of burnt feathers, often with a perceptible smoke, become of a dark-grey colour; and when submitted in this state to the action of acids, there remains undissolved a notable quantity of charcoal. In the recent state they effervesce with weak acids; and when the calcareous matter has been removed, there remains a series of flexible, membranous, or semigelatinous lamellæ, lying parallel to one another, and representing the form of the entire shell. These lamellæ have sometimes a distinctly fibrous structure, parallel to the surface of the shell; and though quite flexible while moist, they shrivel on drying, and become hard like horn,—a substance to which they bear the greatest possible analogy. The nacreous shells, therefore, are always very finely lamellar in structure, and are represented by some as composed of alternate layers of membrane and carbonate of lime; but the more probable opinion is, that the calcareous matter is intimately mixed with the membrane, rather than distinct from it. These shells increase in size, in order to accommodate themselves to the growth of the animal, by the deposition of new and larger layers from within; and hence the external surface is covered by concentric furrows or wrinkles, marking the outer margin of each successive layer.

Between the two classes of shells that I have described are others, the minute structure of which I am ignorant of, but which differ considerably in the proportion and condition of their membranous ingredient.

Thus it appears that all shells, how much soever they may differ from one another in structure, agree in containing carbonate of lime as their only earthy ingredient; and an animal substance, nearly resembling if not identical with, horn or membrane, as their consolidating or agglutinating ingredient.

Exactly the same substances, namely, carbonate of lime and mem-

brane, in various proportions, form the constituent materials of the madrepores and other hard corals.

On examining the hard covering of aquatic crustaceous animals, such as the crabs and lobsters, we find, after the action of acids, that there remains a whitish, soft, elastic cartilage, which represents the original shape of the part, and that the acid solution not only contains lime that had been in the state of carbonate in the original shell or covering, but likewise phosphate of lime, although in smaller proportion than the carbonate. The presence of this earthy salt forms an essential difference in chemical composition between proper shell and the covering of the crustacea, which latter substance may thus be considered as holding an intermediate position between shell and bone.

Some of the corallines, chiefly those belonging to the genera *Gorgonia* and *Antipathes*, approach still nearer in chemical composition to bone; and, indeed, are hardly to be distinguished from it, their earthy part being phosphate of lime with only a small admixture of carbonate, their figure and structure being represented by dense membrane, and, when boiled, they give out a notable quantity of true jelly, which, like other kinds of animal jelly, has the property of forming a precipitate with infusion of galls or of oak-bark.

The proportion of membrane in these substances varies considerably, so that while one species almost exactly agrees in composition with the horn of the stag, others contain so much membrane in proportion to earthy matter, as to be nearly identical with the bone of the cartilaginous fishes.

If a piece of true bone, in an unaltered state, be put into weak acid (muriatic acid, on the whole, is the best,) a moderate degree of effervescence will take place, showing the presence of some carbonate. By a continuance of this process for some days all effervescence and chemical action will cease; what remains undissolved will still represent the size and form of the original bone; but it will be semi-transparent, will exhibit a distinctly cellular structure, will be soft, flexible, and, to a certain degree, elastic. If, after being washed, it is boiled in water, it will be found to be in part soluble; and the solution, when boiled down to a proper consistence, will become viscid, and will gelatinize on cooling, and by drying will be brought to the state of hard glue. This jelly, when again dissolved in water, will become curdy and will give a grey precipitate with nutgall, and will exhibit all the other physical and chemical properties of gelatin; the remaining portion insoluble in water will become hard and somewhat brittle by drying, will burn in the fire like a piece of horn, will dissolve in caustic, fixed alkali forming a saponaceous liquid, and will show all the other properties of albumen or membrane.

The acid in which the bone was first steeped will give an abundant white precipitate of phosphate of lime by means of caustic ammonia, and will give a much smaller precipitate of carbonate of lime by carbonate of ammonia. Thus, by the action of a few simple re-agents, the essential constituents of bone are demonstrated. In this summary I have taken no notice of the oil or fat which is contained in the internal bones of all mammiferous animals, because it seems to be by no

means an essential part of bone; the horn of the stag and of other animals of the same kind being entirely free from it. On this account it is that hartshorn jelly, made by boiling the shavings of stags' horn in water, is often recommended to persons of very weak digestion in preference to other animal jellies, as being absolutely free from oil; for, though hard fat is incapable of dissolving in jelly, yet the softer oily fats will combine with it in small proportion.

But, although it is impossible to draw any marked line of chemical distinction between true bone and the indurated membranous textures that I have already mentioned, yet the mode of their origin furnishes a real and very important difference.

Of the organization of coralline bodies, indeed, we know nothing; for scarcely any of them have been even superficially examined when alive, and, when dried, all trace of structure in the soft parts is completely obliterated.

But with regard to the production of shell, both in univalve and bivalve testacea, we are certain that it never, as such, forms a constituent part of the living animal. A viscid fluid is secreted by certain organs; and it is only when discharged from the body that it assumes the consistence and other characters of shell: therefore, although we may with perfect propriety speak of the structure of shell, as we speak of the structure (that is of the mechanical arrangement of constituent particles) of a crystal, it would be a gross misapplication of terms to speak of the organization of shell; this latter meaning such an arrangement as is compatible with and necessary for the performance of vital functions. Shell is essentially a dead body, or rather one which never was alive; for though naturalists and collectors well know the difference between what they call a dead shell and another, they mean by this expression merely to point out the difference between an empty shell and one, the inhabitant of which was alive at the time of its capture.

The way in which the hard covering of the crustacea is annually formed (for these creatures change their shell every year) has not been sufficiently examined to ascertain whether it is at first a mere exudation which hardens out of the body of the animal, or is an induration of the cuticle by the deposition in its pores of calcareous matter conveyed thither by proper secreting vessels. If the former is the case, the shell of the crustacea is analogous to that of the testacea; if the latter, it some what resembles bone in the mode of its formation.

With regard to bone itself, there is no doubt that it is as truly organised and vital as any other part of the body. As soon as the rudiments of a young animal can be distinguished before its birth, the place of the future bone is indicated by a soft or semi-fluid matter inclosed in a delicate membrane; by degrees both the membrane and the matter which it incloses become more dense and cartilaginous; opaque white spots then appear, which soon after are penetrated by vessels carrying red blood; the deposition of bone then begins, and at the same time the cartilage seems to be gradually replaced by membrane. The rudimental bone, which at first was solid, now begins, at least in the long bones, to exhibit an internal cavity or hollow axis; thus showing that, while fresh matter is continually depositing to supply the growth of the

bone, that which had been already deposited is removed, and that this latter process takes place in the interior of the bone at a greater rate than the other does. The activity of the two vital processes of deposition and removal, or, to speak in technical language, of secretion and absorption, is, of course, proportioned to the rapidity of growth; so that, during the early periods of life, the bones participate with the soft parts of the body in the continual change and flux that is taking place within them. When the full stature of the animal is attained, these two actions probably diminish in rapidity, but still are kept up sufficiently to preserve the life of the part. As old age approaches, the removal of the earthy ingredient of bone seems to become more difficult; its proportion, therefore, to the membranous ingredient increases, and hence the bones of old animals are harder, of greater specific gravity, and more brittle than those of younger ones.

That very remarkable natural process, namely, the annual renewal of the bony horns of the stag and other animals of the deer tribe, is, perhaps, the most striking example and illustration of the circumstances necessary to the formation of bone. These horns arise from a short process or pedestal projecting from a bone forming the upper part of the skull, and called the frontal bone. At the season of the year when the horns are about to be renewed, an increase of vital action takes place in the bone, and a faint red line, indicating the presence of blood-vessels, will be perceived in making a longitudinal section of the bottom of the horn and the base on which it stands; the situation of this red line, indicating precisely the boundary between the dead horn and the live bone; absorption of part of the bone takes place, which loosens the adhesion of the horn to it, in consequence of which this latter falls by any accidental shock which it receives. The spongy tissue of blood-vessels, which may now be seen covering the end of the bony base, is soon entirely covered by the growth of the external skin; and this may be considered as terminating the first part of the process. Soon afterwards a small tubercle arises from the end of the bone, and presses upwards the skin which covers it; the tubercle rapidly elongates, the skin extends with it, and in the course of a few weeks it has assumed the size and shape of the future horn; in this state it is covered by the attenuated skin, which latter has pushed out an abundant growth of short fine hairs resembling the pile of velvet. Beneath this skin is a layer of blood-vessels, the diameter of some of which is equal to that of the little finger; these rest on a thin layer of dense membrane, of the same nature as that which covers ordinary bones, and called the periosteum; and within the periosteum itself is a flexible cartilage, penetrated in all directions by ramifications from the blood-vessels already mentioned.

In this state the future horn is very tender and exquisitely sensible, it bleeds when the skin is broken, and the animal often suffers much in this part from the bites of gadflies and other insects. When the cartilage has attained its full growth, ossification begins by the deposition of phosphate of lime, and goes on till the bone or horn has acquired its complete hardness. During this process, a ring of bony beads has been forming at the base of the horn, in the intervals be-

tween which the main trunks of the blood-vessels lie; these beads enlarge by the continual addition of bony matter, and in so doing compress the adjacent sides of the blood-vessels, and thus diminish the supply of blood; at length the sides of these vessels are quite squeezed together, circulation ceases, and all the soft parts die, shrivel, and dry up, and are rubbed off by the animal against the bough of a tree, leaving the dead bone, or horn, attached by its base to the frontal bone; till, after some months, the time for shedding it again comes round, when a repetition of the processes already described takes place.

Bones, even of the same animal, vary much in structure and in hardness, and no doubt in the relative proportion of their component parts, according to the situation in which they are placed, and the use to which they are put. Thus the shafts of the long bones, being wanted chiefly for support, are more or less in the form of a hollow cylinder, and the texture of the bone itself is dense and compact. Those parts of bones that form the joints or articulating surfaces by which one is hinged on to another require a considerable space for the joint, and for the attachment of ligaments; but as a degree of strength proportioned to its thickness is not wanted, the structure becomes cellular. A similar structure is observable in the flat bones, which consist of two thin parallel tables of dense bone, having a cellular part interposed between them. Hence, in utensils made of bone, the compact cylindrical ones are generally employed, both as being stronger and admitting of a more uniform and higher polish.

The bones of animals belonging to the same general class of nature are commonly observed to have certain points of general resemblance, by which they may be distinguished from one another, and are applied by man to various uses corresponding with such differences. Thus, the bones of fishes are softer, more flexible, and contain a much larger proportion of jelly and membrane, or, which comes to the same thing, a much smaller proportion of earthy matter, than those of the mammalia or warm-blooded quadrupeds; and the bones of these latter, comparatively dense and hard as they are, fall considerably short in density and hardness of the bones of birds, which, however, are generally too small and thin to be applied to much use in the arts.

Bone undergoes, much more slowly than the soft parts of animals do, the process of spontaneous decomposition; meaning, by this term, that disintegration of a compound which takes place either by the chemical re-action of its ingredients on one another, or by means of air, moisture, and common temperatures. The bones of a human body buried in a church-yard are, perhaps, mostly consumed in twenty or thirty years; yet under favourable circumstances they will endure for a much longer time with but little change. Thus, in the charnel-house at Morat in Switzerland, there still remain many bones of the soldiers of Charles the Bold's army, who perished there in 1438, being 401 years ago. When Sir Christopher Wren was rebuilding St. Paul's Church after the great fire of London, the workmen in digging for the foundations came to the floor of a Roman temple, dedicated to the goddess Diana, on which were the horns of stags and

bones of other animals. Tombs of the ancient inhabitants of this island are occasionally opened, in which are found bones that have been deposited there during many centuries; and I have the pleasure of exhibiting to you part of a carved bone spoon (discoloured and passing to a state of decomposition, it is true), which was found in an Etrurian tomb at Vulsinum, in Italy, possibly as ancient as the foundation of Rome. In the valley of the Lea are many peat mosses, the remains of ancient forests, now covered to the depth of several feet with alluvial silt. Many of these have of late years been dug into, on occasion of making docks and other excavations; and in or upon them have been found the osseous remains of boars, stags, and other animals, which have lain there from the time that these creatures roamed wild in the immediate neighbourhood of London. Not only the remains of individuals belonging to species now extant are still found, after being buried for centuries, but the bones of species now extinct, and many of which, judging from the habits of species nearly allied to them and now living, can scarcely exist except in warm climates, are found abundantly in the British islands, and in all parts of Europe. Remains of a large animal of the ox tribe are found in Essex. Elephants, hippopotamuses, and rhinoceroses, differing in many respects from any now known to exist, are also found in the same county, and in other places near London. Hyænas and tigers, also, of extinct species, occur in the cavern of Kirkdale, in Yorkshire, and in other caverns in the west of England; and in certain caverns in Germany are found the remains of two species of bear, differing, in some anatomical details, from any known living species of the same genus. There is no evidence that the human race was contemporary with these creatures; and yet, notwithstanding the enormous length of time that must have elapsed since the deposit of the animals in the places where their bones are now found, many of them are in a state apparently of almost perfect preservation. Membrane and jelly still remain in the bones; but the oil or fat, being uncombined with earthy matter, has disappeared.

In what I have hitherto said, I have alluded very slightly to the use of bone in the arts, which was the ostensible object of the present illustration; for I confess that I have not unwillingly been tempted to enter into the preceding physiological and other details, in order to relieve the dryness of mere technical description. In what remains I shall treat of the practical part of my subject, beginning with an inquiry into the use of bones as articles of food.

All animals that eat flesh will likewise eat bones, provided they are of a size to be easily crushed and masticated by them; so when a lion or tiger has taken one of the smaller antelopes, I presume he devours many of the bones along with the flesh, leaving only the spine, skull, and horns. But when he has pulled down a horse or buffalo, the case is different; the flesh alone of the animal is sufficient for an ample repast; the leg-bones and ribs are not to be cracked by a single straightforward crush of the jaw; and the spine, from its awkward shape, as well as by reason of the strong ligaments by which its parts are bound together, may well resist the lazy efforts

of an animal already satiated with food,—not to mention that the great length of the canine-teeth in the larger animals of the cat kind, as well as the small number of their grinders, render the act of gnawing both difficult and unnatural to them. The half-picked carcass, therefore, falls to the share of the wolves and hyænas. The former, after tearing off the ligaments of the joints, proceed to separate the bones from each other; and then, by gnawing, grind off the softer parts of the spongy articulating surfaces, in which they find a wholesome food. The hyæna, with far greater strength of jaw and of teeth than any other animal of his size, goes to work bodily, especially on the ribs and other flat bones, crushing them into large, splintery fragments, and swallowing them in this state, without fear of being choked or injured by their sharp points and rough edges. These two animals, therefore (including the dog, as a sub-species of wolf), are eminently the bone-eaters; the membranous and gelatinous matter of the bone, being dissolved out by their gastric juice from the earthy portion, undergoes the usual process of digestion; while the latter, apparently unaltered, passes through the intestinal canal, giving to their excrements the well-known appearance of half-dried mortar, and may afterwards be applied to all or any of the purposes for which bone-earth is used.

Man, the cooking animal, extracts nutriment from bones in a different way. When very hard pressed, indeed, he can stave off famine for a while, as Captain Franklin and his party did more than once in their exploratory arctic expedition, by taking bones, which even the wolves had left, and scorching them so as in some degree to subdue their hardness; and thus render it possible to gnaw and masticate them as a succedaneum for food, or, at least, as some alleviation of the agonies of famine.

But the animal matter of bones is best extracted by hot water. Every housekeeper knows that the nutritive quality of meat soups is much increased by boiling the bones together with the meat. In this way, however, only a small proportion of the food contained in the bones is made available; for part of the gelatin is with difficulty, and the membranous part is not at all, soluble in common boiling water; much even of the fat is locked up in cells of the bone, from which it cannot escape except these cells are broken into.

The solid part of the long bones contains very little soluble matter; it would therefore, in most cases, be a matter of economy to exclude them; the advantage to be derived from them by ordinary treatment not being equal to the value of the fuel which they would require. It is from the enlarged extremities of the long bones and their articulating surfaces that the principal supply of nutritive matter is to be derived; these parts, therefore, should be sawed off from the rest and broken into pieces. From the bones of young animals thus treated, boiling water will, in two or three hours, extract the whole or nearly the whole of the soluble matter; but, in the bones of older animals, the gelatin seems to be in a state of condensation approaching to that in which it exists in skin, and therefore requires the long-continued action of boiling water for its separation. By way of experiment, I

had the leg-bone of an ox sawed longitudinally and boiled for three or four hours. At the end of this time, the whole of the fat and mucus had been extracted, with part of the jelly. On applying the finger to the cellular part of the bone when wiped dry, I found the surface to be considerably sticky, and, on examining the cells, I found many of them completely filled with a transparent substance scarcely viscid, but much resembling pieces of glue that had been put to soak in cold water; by which, as every one knows, the glue swells exceedingly by absorption of the water, without, however, becoming viscid. A second boiling for three or four hours in fresh water dissolved out a considerable proportion of the gelatin; but still the surface of the bone remained sticky, many of the cells had a glazed surface, and, even after a third repetition of the boiling, only a few even of the superficial cells were quite empty. It is evident, therefore, that we cannot avail ourselves, with any regard to economy of fuel, of the whole of the nutritive matter contained in bones by the action of boiling water applied in the common way. But by means of a digester—that is, a boiler with a steam-tight cover and a safety-valve—we can without hazard raise the temperature of water from 212°, its boiling point in the open air, to 270° or 280°. At a less heat than even the former of these, not only the condensed gelatine but also the membranous part of bones is dissolved, if the bones have previously been reduced to small pieces, and the undissolved residue will be found to be a friable crumbling mass, with scarcely any remains of animal matter. It appears that bone soups are thus prepared at present at some of the hospitals and military head-quarters in France, and memoirs have been published, stating the advantage of making a collection of dry bones as part of the provisions of a garrison in case of siege, being a kind of food scarcely susceptible of decomposition or of destruction by rats or mice, and which would require no other magazine than simply making them into stacks and covering them with a roof of thatch or any other material. Complaints, it is true, are made of the burnt flavour which such soups are liable to have, and perhaps it may not be very easy to regulate the temperature of the water in the digester so as to avoid the empyreumatic flavour, and at the same time completely to extract from the bones the animal matter. On this account it is that another scheme has been proposed, namely, to put the bones, after soup has been made of them by boiling in the common way, into a stone trough, and then pour on them very dilute muriatic acid. By repeating this process in the cold a sufficient number of times, the whole of the earthy matter will be dissolved out, and probably without much, if any, injury to the animal matter, which will remain in the form of a porous membrane; by repeated percolations of water the acid would be washed out; or, if a little should remain, a last sprinkling with a solution of carbonate of soda would convert the acid into common salt. The membrane being now dried in the air will acquire a horny hardness, by which it will be rendered almost incapable of spontaneous decomposition, and would probably be found to be much more easily convertible into palatable human food by the common processes of cooking than the entire bone.

The plan, to say the least of it, is plausible, provided muriatic acid may be had, as it now may be, at a very small cost.

There is, however, a whole class of animals, the bones of which, without any chemical preparation, are presented to us by nature in a state capable, with very little trouble, of being converted into nourishment. I mean the whole class of fishes. The bones of these creatures contain so little earth, that, by drying and grinding them, a powder is obtained which, when made into cakes with meal, has proved a valuable resource to the people of Norway and Sweden in times of scarcity; and some of them, by simply browning on a gridiron, become quite friable, and, when treated with a proper quantity of pepper and salt, form a very palatable article of food.

Trans. Soc. Arts and Man.

Steam Navigation in France.—Extracts from the Report of Count Daru to the Chamber of Deputies, in the name of a special Commission intrusted with the examination of a projected law relative to the establishment of Steam Packets between France and America.

The form, dimensions, and power of steam-boats evidently depend on the service to which they are destined. They were not long merely employed in the ascent and descent of rivers, but soon the limits of steam navigation were enlarged, increasing the power of the engines from 20 to 80, 160, 200, and 250 horses, it became possible to extend the field of their employment to venture on the sea with them. Towing boats, which had been constructed in a few ports, soon threw a light on the superiority of the new system, by bringing out large vessels, weather bound and condemned to inactivity, and drawing them in their wake with a facility which seemed to defy the elements. From that day the bright days of sail-navigation, which, till then, was looked upon as the *chef d'œuvre* of human understanding, were eclipsed. Now vessels were started on every coast. Regular and rapid communications linked together every important town, such as Havre, London, Dover, Hamburg, Rotterdam. This was the forerunner of more daring attempts.

In 1819, a vessel from the United States, "the Savannah," had crossed the ocean from Liverpool to New York,* partly by wind and

* The first Atlantic steam voyage of the "Savannah" was from Savannah, Georgia, to Liverpool, and *not* "from Liverpool to New York." We find by her log book, which is now in possession of the American Philosophical Society, and which appears to have been kept with great precision, that she left New York under the command of Captain Moses Rogers, a native of Connecticut, on the 28th of March, 1819, and arrived at Savannah on the 6th of April; where the captain found it necessary to remain some days to take in fuel and put things in order, after which he sailed for Liverpool, where he arrived on the 20th of June.

About the middle of July he left Liverpool for the Baltic, reached Elsineur on the 9th of August, and left it on the 14th; put into Stockholm, and left it on the 5th of September; went to Cronstadt, and from thence to St. Petersburgh. Sailed again on the 10th of October, went to Copenhagen, and finally returned to Savannah, and from thence went to Washington.

partly by steam. America, then, had the lead again in daring to apply Fulton's machine to long voyages, and this is the more remarkable, that it has always had but few steam-boats on sea service. This first essay was not repeated until in 1835, when the English undertook the passage from Falmouth to the Cape of Good Hope; the Atlantic, provided with an engine nearly similar to that of the Savannah, accomplished in 37 day a distance of 2,400 nautical miles. The Berenice, the Medea, the Zenobia, performed passages of different lengths on the coast of Africa, and in the Indian seas. All these boats were English. In the Mediterranean, steamers of different nations, Neapolitan, Sardinian, Austrian, French, crossed from one port to another. Lastly, our service of steam packets from Marseilles to Alexandria was established, and threw open to us a new access to the East. The passage to Constantinople, which was sometimes forty-five days in duration, was thus reduced to thirteen and a half days.

These numerous experiments gave rise to the idea that, by the aid of steam, it was possible to accomplish the distance between Europe and the United States. The difficulty of carrying the necessary quantity of coals for the consumption of an engine acting, without interruption, from one shore of the ocean to the other, during a space of from fifteen to twenty days, was no longer an obstacle. It had been discovered that the consumption of combustible did not increase in the same ratio with the power of the motors,—that an engine of 250 horse power, for instance, was far from burning twice as much fuel as was necessary for an engine of 125 horse power; that, moreover, certain parts of the mechanism might be simplified in such a manner as to take up less room, and consequently, leave more space at disposal for the accommodation of passengers or merchandise. From this time operations were commenced, and on the 4th of April, 1838, the first experiment was tried. You are all acquainted, gentlemen, with the result. You all beheld the enthusiasm excited by the success of the vovage undertaken by the Sirius, fifteen days had been sufficient for its passage. Scarcely had this vessel arrived in the port of New York, when it was joined by the Great Western, which started from Bristol on the 8th of the same month, after a passage of fourteen days.*

Henceforth the problem was solved. America was nearer the European continent by half the distance which formerly separated them. There could be no more doubt concerning it; the events which have since occurred have ratified these first expectations.

The Great Western has crossed the Atlantic twenty-eight times during the period of the fourteen months just elapsed without accident, maintaining an almost uniform speed, of which the average time was

* The length of this boat is 236 feet, its depth 23 feet 3 inches, its width outside the paddle boxes 58 feet 4 inches, draught corresponding to the load, 16 feet, tonnage 1,340 tons. The engines are so constructed as to diminish the consumption of steam and fuel. It is said that they consume 33 tons of coal a day. The total cost of the vessel when it was launched was 55,000*l.*; since that time improvements have been effected in it which have amounted to 15,000*l.* It carries 700 tons of goods, 135 passengers. The rest represents the weight of the engine, the boilers, and the water.

sixteen days going, and from thirteen to fourteen days coming back: the last voyage was even accomplished in eleven and a half days.

During two years, since they begun their operations, with what strides have the English advanced?

A first line from Bristol to New York was established in 1838. The company to whom it belongs has four steamers of 450 horse power —namely, the Sirius, the Great Western, the Royal William, and the Liverpool. The price of each of these boats is 1,300,000f. It is said that they now are building an iron steamer, which is to carry two engines, whose united powers will amount to 1,000 horses. These engines were constructed on the plan of Mr. Humphreys; the boat will only be 100 metres in length, and will have room for 300 passengers, and a considerable quantity of merchandise. The works are in active continuation, and will be terminated, according to appearances, in the course of the year 1841.

Another line was established for the service of London and New York. Two vessels were employed on it—the British Queen and the President; the engine of the British Queen was of 500 horse power, that of the President 600; they can accommodate from 225 to 250 passengers, and receive a load of from 500 to 600 tons. A third line connects New York to Liverpool, so that there are already three establishments sending steam vessels from different parts of Great Britain to the United States.

Moreover, a compact was sealed on the 4th of July, 1839, between the Admiralty and Mr. Samuel Cunard, for the transit of letters from Liverpool to Halifax. Mr Cunard has engaged that there should be two departures per month, and receives from the Government an annual remuneration of 1,500,000f. The Britannia, of 450 horse power, was launched into the sea in the beginning of February, 1839.

Lastly, a more extensive service will soon connect Great Britain with the West India Islands; there is a company in existence under the name of the Royal Steam Navigation Company, which is preparing vessels for New Orleans, Mexico, and part of the South American coast. This company the Government indemnifies by an annual payment of 6,000,000.

You must all perceive, gentlemen, that we must not delay entering into the lists, for we are urged on by competition from every quarter, and the appearance of English steamers on every point of the New World to the exclusion of our own, would soon banish us from those regions.

However serious the character of these motives, gentlemen, they are, however, secondary when compared to the consideration which we will not endeavour to conceal. The navy is a weapon, and one which to all appearances is destined to play an important part in the conflicts which a future day may bring to light. Attempting to foretell what consequences may be reserved for a future period by the introduction of steam in constructing ships of war would be presumptuous; it is a question of entirely recent origin; experiments with regard to it are in their infancy. It is, however, already discernible that the use of new motors will infallibly produce the following effects:

—In the first place, it will render every vessel in similar conditions equally supple and tractable, by whatever men she may be manned. It will be sufficient to have able engineers in order to effect manœuvres with a facility and precision as entirely independent of the state of the sea as of the greater or less aptitude of the sailors.

Secondly, the number and proportion of the men required for the performance of the ship's duty would be entirely changed. The Great Western, whose form and dimensions are nearly those of an ordinary frigate, is conducted by fifty men, including engineers and stokers. Now, if it be true that the naval enrolment of France is incompetent to supply all its necessities, this inconvenience will vanish; and the more so, because the zone in which we shall be able to find men fit for the service will be extended.

Lastly, the draught of water occasioned by a steamer depends upon its power; but for all it is less than that of ships of war. Whence it follows, that instead of the five or six ports to which our vessels and frigates can resort, steam-boats will be able to cast anchor off any coast, and, so to speak, in any bay.

Thus the new vessels provided with a good engine will be swift, will offer less hold to the enemy, will have a greater number of safe harbours to resort to, will require a less numerous crew, and require less previous apprenticeship than in sailing vessels. This will evidently become a new weapon; and if these ships carry guns for the discharge of bombs of a recent invention, whose effect is such that at one discharge they are capable of disabling the largest craft, they will become a weapon at once easy of management, safe, and of the most destructive nature. Is there not wherewithal here to change the whole direction of naval tactics, all the proportions existing between the powers of nations? Here is an entire revolution. Slow or fast, partial or complete, this revolution will ensue. Now, with the example given us by a Government whose energetical endeavours are dedicated to the continued increase of its naval resources, when we see Great Britain during two years continually multiplying, at the cost of such enormous sacrifices, its steam navigation, and finding in the gigantic establishments of its industry those inexhaustible resources of which we are deprived, would it be wise, would it be prudent, to continue our *materiel* in its present state, to abstain from making some progress in the new career which has been traced out to us? Undoubtedly we do not indulge in the chimera that our country can ever equal the English in their naval establishment. The strength of the British nation rests entirely on its foreign trade; they are an exclusively seafaring nation. All the springs of its prosperity are there; it drags after it that colossal superiority which constituted at once its greatness and its peril. The conditions of existence in which France is situated are different; but the extent of its coast, its position, the genius of a portion of its inhabitants, compel it to possess a navy, and in that case it is becoming that, wherever she may be pleased to hoist her flag, she may be enabled to assemble and display a sufficient force in order to

insure respect. Without this she could never effectually protect her national interests beyond the seas.*

The construction of steam-boats for transatlantic voyages presents, then, a double object to our view. Applied, in time of peace, to the growth and preservation of our commerce, they may be transformed, during hostilities, into ships of war; they may assume, in turn, the double character of a defensive weapon and of a means of conveyance —of a commercial and of a military navy; to-day they may carry merchandise, and when requisite guns. Civ. Eng. & Arch. Jour.

Steam Packets to convey the Mails between France and America.

We, Louis Philippe, King of the French, have proposed, the Chambers have adopted, we have ordered and do order the following:—

Article 1. A line of steam packets shall be established in order to convey the mails between the ports of Havre and New York.

The Minister of Finance is authorized to treat, within the space of three months, with a commercial company who will undertake the service, on condition that they receive in payment an annual fee not exceeding 880f. per horse power. The number of steam packets to be employed in the service of this line shall be three at the least, or five at the most; each packet to be propelled by engines of 450 horse power.

A list of conditions, to be drawn out by the administration, will determine the times of departure, the number of passengers, and every detail relative to the service of this line.

2. Two principal lines of communication shall be established by the Government, in order to convey the mails between France and America, and served by steam packets of 450 horse power, one starting from Bordeaux every 20 days, and from Marseilles every month, in order to arrive at Martinique, and continuing by Guadaloupe, St. Thomas', Porto Rico, Cape Hayti, and St. Jago, to Havanna; the other starting from St. Nazaire every month to Rio Janeiro, passing by Lisbon, Goree, Pernambuco, and Bahia. Three secondary lines, served by steamers of 220 horse power, will be established in order to continue the principal lines, the first to Mexico, touching at Vera Cruz, Tampico, Galveston, and New Orleans; the second to Central America, touching at Chagres, Carthagena, Santa Martha, and La Guayra; the third to Montevideo and Buenos Ayres.

To effect this a special credit has been opened to the Minister of the Navy, to the amount of 28,400,000f., to be devoted to the construction, arming, and fitting up of 14 steam packets of 450 horse power, and four steam packets of 220 horse power, and which is to be appropriated to the expenditures of 1840, 1841, 1842, and 1843.

* England had, in 1831, 840 commercial steam-boats, representing altogether 64,700 horse power. Besides which, the English Admiralty possesses 66 vessels, whose powers amount to nearly 9,400 horses, while in France we reckon only 640 commercial steamers, and 38 belonging to Government.

From the total sum of 28,400,000f. a grant is made to the Minister of the Navy—

	Francs.
1. For the year 1840, of - -	5,000,000
2. For the year 1841, of - -	10,000,000
Total - - - - -	15,000,000

3. The steam boats belonging to the Government shall be constructed so as to enable them, in case of necessity, to carry guns, and when performing the duty of packets to carry merchandize. Ibid.

Incrustation in Steam Engine Boilers.

We are informed by *L'Echo du Monde Savant*, of the 25th of July, that M. Edouard Richard had presented to the Geological Society of France a calcareous incrustation, which must be considered of great value, as it was not formed in the boiler, but in the cylinder of the engine, and beneath the piston. The incrustation formed a disc 12½ centimetres in thickness; and in consequence of the pressure of the piston, it is so hard that it is capable of receiving as high a polish as the densest marble. It is evident, therefore, that explosions may be produced as well by calcareous concretions of the cylinders as of the boilers of steam engines. The engine from which this specimen was procured, has been used for the purpose of pumping water from the mine of Auzin, and has been built after Newcomen's plan.—In *L'Echo du Monde Savant* of August the 5th, we find a communication upon the subject of steam boiler explosions by M. Flesselle, a retired officer of the French Marine, resident at Graville, near Havre. M. Flesselle suggests, that, in order to prevent the formation of calcareous incrustations, (which have long been considered the principal causes of accident,) some common salt or muriate of potash, should be put into the boiler with each fresh supply of water. M. Flesselle recommends this measure, because the incrustations are formed of the carbonate, the sulphate, and perhaps the phosphate of lime—(salts, insoluble, or sparingly soluble;) and these salts, boiled with the muriate of soda (common salt,) or muriate of potash, will undergo double decomposition with these muriates; the products being the carbonate, sulphate, and phosphate of soda, and the muriate of lime—salts all of which are soluble.

M. Flesselle says that M. Chaix, of Maurice, has invented a method of preventing explosions, which appears to have been adopted with success in the French government steam vessels; but M. F. considers that auxiliary means also are requisite—and we think he is right; for the fact we have related regarding the engine at Auzin, proves that we should avail ourselves of every cheap and simple aid to prevent the fearful accidents to which incrustations may give rise, seeing that the sulphate, carbonate, and phosphate of lime may be held in suspension by the steam—be carried by it in a state of minute molecular division even into the cylinders—and there also be deposited in the form of hard concretions.—The method of M. Flesselle, seeming found-

ed on correct chemical principles, will, we hope, be put to the test of experience, by some of the numerous engineers of our neighbourhood. We shall feel great pleasure in recording the result.

In England the precaution taken against incrustations is an index of the density of the fluid in the boiler; but this is evidently inadequate —for the calcareous particles are conveyed by the steam into the pipes and cylinder. Perhaps some of our scientific readers will have the goodness to inform us whether the English method of preventing incrustations is identical with that of M. Chaix.—*Gateshead Observer.*

Ibid.

On the Construction of Lime Kilns. By Sir C. G. Stuart Menteath, *Bart.*

Having been engaged in burning lime for the supply of an extensive district of country for agricultural improvements, and being distant from coal sixteen miles, it was desirable to find out the best constructed kiln for burning lime with the smallest quantity of coal, and having been aware from experiment that the kilns generally employed in Great Britain for burning lime are of a construction too narrow at bottom, and too wide at top, many kilns of this construction being not more than three or four feet wide at bottom, and 18 feet wide at the height of 21 feet, were found to waste the fuel during the process of calcining the lime, or in other words, did not produce more than two measures of burnt lime shells for one measure of coal; but it is to be understood, that in whatever construction of kiln lime is burnt, the fuel required to burn limestone must vary according to the softness, or hardness, or density of the stone, and the quality or strength of the coal used. The same measure of coal in Scotland called chews, when employed, will burn a greater quantity of lime in a given time than the same quantity or weight of small coal, the chews or small pieces of coal admitting the air to circulate more freely through the kiln. Though this fact should be well known to lime-burners, yet they frequently employ small coal in burning lime, from its being procured at a less price, though really at a greater expense, as it requires a much larger quantity to produce the same effect, and a longer time to admit of equal quantities of lime being drawn out of the same kiln in a given time.

For a sale of lime for agricultural purposes in a limited district, I have found kilns of small dimensions to be most profitable; the construction of a kiln I have employed for many years was of an oval shape, five feet wide at bottom, widening gradually to six feet at the height of 18 feet, and continuing at that width to 28 feet high from the bottom. A kiln of this construction has been found to burn lime in much less time, and with a smaller proportion of fuel, than kilns of large dimensions, narrow at bottom and wide at top, as heat is well known to ascend more rapidly in a perpendicular than in a sloping direction, from which arises the superiority of a narrow kiln, with sides nearly perpendicular, compared with one with sides that slope rapidly.

Those narrow kilns will admit of being drawn out of them every

day, if fully employed, more than two-thirds or nearly three-fourths of what they contain, of well burnt lime, and afford fully three of lime-shells for one measure of coal, when large circular kilns will not give out more than one half of their contents every day, and require nearly one of coal for every two measures of lime burnt. In a country sale of lime, the quantity sold every day is liable to great fluctuations; two or three cart loads will sometimes only be required from an establishment which, the day before, supplied forty; and as lime is known to be a commodity, when exposed to the action of air, which becomes more bulky and heavy, and in that state does not admit of being carried to a distance without additional labour, it has been an object of importance with me to find out a construction of a kiln which will allow of lime being kept for several days without slacking, and at the same time to prevent the fire escaping at the top of the kiln, if the kiln stand twenty-four hours without being employed, especially during the autumn and winter when the air is cold and the nights long. I now employ kilns of an egg shape, and also oval; the oval-shaped kilns are divided by arches across the kiln, descending four feet from the top; the object of the arches across the kiln is to prevent the sides of the kiln falling in or contracting, and also to enable you to form circular openings for feeding in the stone and coal at the mouth of the kiln; upon this plan, a kiln of any length might be constructed with numerous round mouths. From the great expense attending the driving of fuel from a distance of twenty-five miles from my own coal-pits, I have adopted the practice of cokeing the coal, which is a saving of two-fifths of the weight, and I find that an equal measure of coal and coke have the same quantity of heat in burning lime, which is somewhat paradoxical, but not the less true. The coal is found to have little effect upon the stone till it is deprived of its bitumen, or is coked in the kiln; for, during the time the smoke is emitted from the top of a lime kiln, little or no heat is evolved; or, in other words, does not the smoke carry off the heat, which is not given out from the smoke till it is inflamed, which does not take place in the ordinary lime kilns? A kiln in which coke is the fuel employed will yield nearly a third more lime shells in a given time than when coal is the fuel, so that coke may be used occasionally when a greater quantity of lime is required in a certain time than usual, as it is well known to lime burners that the process of burning is done most economically when the kiln is in full action, so as almost constantly to have a column of fire from the bottom to the top of the kiln, with as short intervals as possible in working the kiln.

Having found that limestone is apt to be vitrified during the process of calcination during stormy weather, from the increased circulation of air through the kiln, which adds much to the heat derived from the fuel employed, and which experienced lime-burners would have diminished could they be aware at all times of an occurrence of this kind; from having experience of the bad effects of too great a circulation without properly providing against it, I have reason to believe that by having a power to throw in at pleasure an additional quantity of air into the bottom of a lime kiln, a considerable saving of

fuel necessary for the calcination of lime would take place, and another object would be gained, that of cooling the limestone in the bottom of the kiln, which frequently retards the drawing out of the burnt limestone for some hours, or until the limestone is so cold as not to burn the wooden structure of carts.

In working a kiln with narrow circular mouths, the stone and coal should be carefully measured, so that the workmen can proportion the fuel employed to the quantity of stones, and it is obvious, that the quantity of coal to be used must depend upon its relative quality, and the hardness of the stone to be burnt. If this measure was adopted in kilns of any construction, the lime shells would be found better burnt.—[*The Dublin Advertiser.* Civ. Eng. and Arch. Jour.

Galvanic Battery.

Much difficulty arises in naming the two poles of a battery; they are called the positive end and the negative end, the anode and the kathode, the platinode and the zincode; now as each pole of a simple battery becomes reversed if the battery is doubled, Mr. Smee proposes (*Philosophical Magazine*, for May) to name the two ends from the oxygen and hydrogen, since it has been shown that the galvanic current owes its power of decomposing many substances entirely to these gases. The names which are proposed are the *oxode*, at which oxygen is evolved, and the *hydrogode*, where the hydrogen is given off. Mech. Mag.

On the Augmentation of the Force of Powder by the Admixture of other Bodies. *By* Mr. Mayer, Mining Superintendent at Gengenbach, near Offenburg, in the Dutchy of Baden.

As it may be interesting to such of your readers as are engaged in mining pursuits, to be made acquainted with the various results in different districts, of the method now known for several years of mixing powder with sawdust, in order to obtain increased effect in blasting, I hope it will not be unacceptable to them and to the mining public in general, if I present them the following details of the experiments made in this district; since, by comparing these with other trials, improvements may probably be suggested in the method of procedure:—Our first efforts were directed to ascertain the exact proportion of the sawdust to the powder, in order to obtain the maximum of expansive force; and it was found, after numerous trials, that in some of the mines of this district, where one pound of powder was formerly used to make up six cartridges, now nine cartridges are made up with the mixture. In other mines of the Grand Dutchy of Baden, and particularly in my own official district, one pound of powder used to be requisite to fill eight cartridges, but on being mixed with sawdust, one pound of powder was sufficient for twelve cartridges; and, afterwards, on our becoming more skilled in the management of the whole

process, sixteen cartridges were made from the same quantity—an increase of one-third, and subsequently of one-half in the number of cartridges—the effect being found equal to what could be expected from powder alone, and failures in the blast not being more frequent than is usually the case in all mines; of this I have been an eyewitness, in a very great number of instances.

It has been objected that the additional length of the cartridges would render it necessary to work a deeper hole in the rock, so that the increased labour required would in part counterbalance the saving of powder; but to this remark I have to reply, that the superior elasticity of the mixture admits of the six-inch cartridge being pressed down by the clay to the length of four inches only, and consequently, in a hole ten or eleven inches deep, there remains six or seven inches for the clay, which is, beyond doubt, quite sufficient; and it may be observed, that the holes are very seldom worked to a less depth than ten to eleven inches. In some places, however, the mixture has not met with the same approbation; but I am not able to state whether this be owing to a want of correctness and attention in the operations, or to a lurking prejudice against innovation.

The objections which had been brought forward against the sawdust, led me to reflect whether some other substance might not be equally efficient, and an incidental circumstance seemed to indicate the very material. Being out with a shooting party, after firing my piece several times, I found myself at a loss for wadding, and, in the hurry of the moment, made use of some envelopes of letters, on which there was a more than ordinary quantity of sealing-wax. I had scarcely pulled the trigger, when I experienced a gratification not generally calculated upon by sportsmen—that of being, in no very gentle manner, extended on the turf—and the pain I felt in the shoulder and head, might have made me wish I had postponed the shot till my next excursion, if I had not thought I had made the very discovery of which I was in search, since I naturally attributed the force of the charge to the sealing-wax. On my return home I made some trials, not with the usual component parts of sealing-wax, but with the colophorium (resin) alone. For a bore requiring two ounces of pure powder, I took one and a half ounce, adding the eighth-part of an ounce of powdered resin, which was combined with the powder by friction on a sheet of smooth paper, the mixture being indicated as accomplished, when the black colour of the powder assumed a yellowish hue from the resin. Being filled into a cartridge for a hole sixteen inches deep and one inch in diameter, bored in a granite block of great hardness, and two and a half feet long, two feet wide, and two and a half feet high, the cartridge occupied three inches, and the remainder was rammed with heavy spar. The explosion was perfect, and the mass burst into four nearly equal pieces, besides several small ones—one of the former being thrown a distance of four paces. Concluding from this excess of force, and from the well grounded report, that less powder would do, I tried, in a similar hole, one ounce of powder to one-sixteenth of an ounce of resin, and I was pleased to find the effect fully equal to what might be expected from two ounces of powder alone.

After these experiments, I found it easy to account for the violent recoil and loud report of my fowling-piece—the resin having produced a more immediate and rapid ignition of the whole mass. It is to be observed, that on using unmixed powder, many of the grains are lost, as is evident from the black streaks discernible after shooting over snow with the gun muzzle near the ground—the piece being held horizontally. These marks or streaks of powder must generally consist of one-half of the charge, but similar appearances are not visible on using the mixture. I was now so fully convinced that this last mixture would effect a saving of one-half of the powder, that I immediately introduced the use of it in these mines, where it has ever since, namely, a year, been used with the same uniform result, and has even been adopted in a colliery, where the managers had previously tried the sawdust without success.

On using this mixture of colophorium, there never occur those so called (Bichsen,) but the whole rock round the hole is sprung from the powder-bag; and, moreover, it is observed, that the blast takes effect in almost every case below or behind the bore in the rock itself.

With regard to the expense of the commonest resin, which is what I use, the value of one ounce of it to one pound of powder is very little; and even the finest resin, at two kreutzers the ounce (about three farthings,) saves a pound of powder, which usually costs from twenty-four to thirty kreutzers (from 8d. to 10d.)

I next made trials with the *semen lycopodii*, which possesses in a high degree the qualities requisite for the immediate combustion of the powder, and found it to produce the same effects as the mixture with sawdust or with resin; but as a pound of this seed will suffice to mix with powder for 512 blasts, I consider that its application may be advisable when it can be procured in sufficient quantities.

Mining Review.

NOTICES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE, BY J. GRISCOM.

The Paris Fair of 1839.

The exposition of the objects of French National Industry at Paris, in 1839, was a brilliant affair. A building was erected under the direction of M. Moreau, the government architect, in the great square of the Champs-Elysées, six hundred feet long, and two hundred and seventy wide, fronting on the grand Avenue. The façade exhibited five openings, the central one being decorated by a saillant peristyle, and the continuous acroter which crowned the façade was divided into compartments, on which were inscriptions in bas-relief which announced to visitors the divisions and classifications of the objects of the interior.

The bas-reliefs, ingeniously devised by the architect, exhibited the different branches of industry, being represented by children or little genii, performing the manual and theoretical operations which

brought forth those rich productions (plates representing these designs are given in the *Recueil de la Societié Polytechnique*, for May, 1839.) We have thought it would not be uninteresting to our readers to be in possession of the substance of the address to the king, and his reply on the occasion of this splendid exposition. G.

Discourse addressed to the King, by Baron Thenard, President of the Central Jury.

Sire,—It was a happy thought which conceived the plan of exhibiting specimens of all the most remarkable fruits of the industry of a great population, and of perpetuating the remembrance of it by rewards imposingly distributed by the head of the nation.

This idea is the more worthy of France, inasmuch as it was first accomplished when she was combatting with all the powers of Europe, leagued against her independence.

More than forty years have since elapsed; the plan has of course been subjected to the ordeal of time, and the still more trying ordeal of political revolutions.

The consulate received it from the directory to attach it to the empire, which, in turn, transmitted it to the restoration. The government of July adopted it as a National Institution.

Its early operations could not fail to be injured by the calamities which war always brings in its train; but peace was no sooner re-established and consolidated, than industry, which had been, as it were, enchained, sprang forth afresh, kindled under the light of experience, and penetrated into regions where it was before unknown. The fairs of 1819 to 1827, revealed to England the truth that she would soon have a rival in the arts. These high hopes were justified by the exhibition of 1834, and are realized by that of 1839.

Yes, sire, a grand progress has been made within the last few years.

Wool spinning by machinery we have completely acquired; that of flax will not be long in arrears. These are arts which will form important additions to the balance sheet of our commerce.

More than fifty factories have constructed steam engines of common force; let the state assist them and soon will they furnish those powerful motors which our marine and our industry are now demanding. Steam factories were scarcely in existence in France at the beginning of the present century; now they are counted by thousands; our manufacturing villages will in time be covered with them.

Paper machines for continuous sheets have been carried to so high a degree of perfection that they are exported to foreign countries.

The Jacquard loom, so eminently useful, has received new improvements.

An ingenious mechanism fashions wood into furniture, ornaments, gun stocks, &c., with great rapidity and precision.

Excellent tried chronometers cost one half less than in 1834; all our ships will be provided with them, and will be no longer in danger of a fatal coast in stormy weather.

From England came all the needles requisite for our use,—France now produces them in the most desirable perfection.

New products have sprung up in our factories; the starine candle, so unexpectedly pleasant; the dye of prussian blue, which in time will supersede entirely the use of indigo.

Our flint glass is as limpid and of as perfect a cut as foreign glass—it is sought for from abroad on account of the elegance of its forms, the variety of its colours, and the solidity of its metallic decorations.

Nothing more beautiful and splendid than our window glass;—it surpasses that of the ancients, so justly extolled.

The manufacture of flint and crown glass by a systematic process, which would furnish them of perfect quality and convenient dimensions for all optical purposes, has been long an object of anxious search; this important problem is now solved.

A great advance has been made in the mode of decorating porcelain and increasing its value.

Lithograpic stones, of superior quality, have been discovered in several parts of the kingdom; and the rarest works can now be reproduced by lithography, with all the characters which distinguish them.

The beautiful marble of our Pyrenees, scarcely known fifteen years ago, now not only suffices for our own wants, but has become an article of considerable export.

Iron is preserved from rust by means very simple and apparently efficacious.

Laminated bronze lines our vessels, and insures them a duration greater than those of copper.

Nitre, by an improved process, is manufactured in competition with that of India.

Our calicoes, silks, and shawls are constantly displayed in the shops of London, and our muslins, plain and embroidered, seem driven from our markets to those of England and Switzerland.

In the management of silkworms great progress has been made; a great number of mulberries have been planted; and there is every reason to believe that in ten years France will be relieved from the tribute which she is paying to foreign countries, the amount of which is not less than 40,000,000 francs annually.

Starch is transformed, at the will of the manufacturer, either into a low priced sugar, which serves for the improvement of wine and beer, or into dextrine, which takes the place of gum senegal in calico printing, colouring, and dressing cloth. The fabrication of these articles amounts to 6,000,000 kilogrammes (=14 mill. lbs.)

Eight years have scarcely elapsed since England furnished us with all the varnished leather which our consumption required. At present England is obtaining it from France. In the art of tanning great progress has been made. Our moroccos obtain the preference in every market.

All the branches of industry have improved; in almost all the prices have fallen.

(The President proceeds to descant upon the vast accessions of the arts and to human skill and power which have been witnessed within the last forty years,—claims for France and Papin the *invention* of the steam engine, but ascribes to Watt its *perfection* and applications.

He brings into view as the causes which have produced these wonderful results:—)

Peace, which is the soul of industry; Science, which sheds a most vivid light upon the arts, and preserves them from the errors of a blind and deceptive routine of action; learned societies, and especially *la sociétié d'encouragement* which, by its numerous and energetic assemblings, have resolved the most important and difficult questions.

(Another cause to which much of these effects is assigned is the public exhibitions, bringing together vast numbers of all classes to witness the progress of art, and the beauty of its productions, tending to aggrandize the French name, and to make the people proud of their country. In a few years they will have nothing to envy from England.)

Yourself, Sire, and by your example the Prince Royal, have been happily convinced, while, surrounded by your august family, you have spent whole days in visiting the exhibition with so lively an interest. Every fresh visit has been a source of increased pleasure. It has induced you to address congratulations to the manufacturers with whom you have been pleased to converse, and your praises have been the more touching from the paternal kindness which have accompanied those evidences of discernment which an intimate knowledge of the arts could alone confer.

In fact, when we consider what was the state of things at the termination of the empire, and what it is now, who can tell where the progression will stop if its rapid march is not suspended by WAR? Its destinies will be immense. Enlightened by science, it will imprint its character and genius on the age, and there will hereafter be ages of industry as there has been ages of warriors, and ages of literature and painting.

Sire, you have been able to preserve peace in the midst of a revolution which might have produced a general conflagration. Your exalted wisdom will be able to sustain it; this will be your work and your glory. A new era, a pacific era, will take its date from the foundation of your dynasty. Instead of destroying, you will build up. Already have you saved from certain ruin the palace of a great king, by founding upon it this monument, this historic museum, which alone is sufficient to render one reign illustrious. You will cause letters, science, and all the arts to flourish; you will vivify agriculture; you will cause commerce to reach the most distant countries; you will every where spread the blessing of civilization.

History will not inscribe your name among conquerors, but posterity, just in its decision, will place you, sire, in the list of kings who have been the fathers of their people,—of crown princes, rare indeed, who devote their lives to the salvation of their country, and who use their power only to give a more useful direction to the true sources of public prosperity.

The King's Reply.

To perform this task is the first of my duties;—to learn from you that I am advancing towards its accomplishment is the sweetest re-

ward that I can receive from my labours, and my efforts to secure the happiness, the greatness, and the prosperity of France. Gentlemen, I was impatient to be in the midst of you, to thank you in the name of my family and for myself, for all the sensations you have inspired me with, whenever I have visited this magnificent exposition which you have just given to France;—to tell you how intimately I feel myself associated with your labours, and how pleased I am in believing that their constantly increasing results will justify the high hopes which your worthy President has just presented to my view. I agree with him that it is to the epoch of that terrible crisis in which so many sacrifices were made by the nation,—in which every French heart sprang from its fireside to the defence of its country,—abandoning its profession, its family, its dearest interests, to preserve France from foreign invasion,—that was commenced the long series of expositions of its genius which years have just crowned in so brilliant and splendid a manner. In the very deficiency of those early efforts, might be seen an expression of the wish of France to urge its government and those who then presided over its destinies, to put an end to the scourge of war as soon as the honour of the country should be satisfied, and its independence secured. In fact, the vow of France and its first necessity was to enter into a state of peace, the only means of regaining all the safety and repose necessary to the free indulgence of its genius and the full development of its best faculties. In was, in some sort, a salutary warning that the time had arrived when the resources of France should be applied to its real wants, and no longer absorbed in the pursuits of chimerical conquests, in the subjugation of its neighbouring people, and in the extension of a domination in which we have no interest nor any desire of persevering. But these times of trial are already remote; the national wish has prevailed. Internally tranquil, we are at peace with all our neighbours, and nothing need disturb you or constrain you in pursuing after those combinations in which you are so happily engaged. It is by a judicious employment of all our resources, that private fortunes must continue to increase and ease and comfort spread from family to family. You have already succeeded in furnishing the poorest and most necessitous classes with the low priced stuffs which clothe them, in satisfying their wants, and in procuring for them comforts until now unknown, by the reduction of prices to the means within their reach. For these blessings you deserve their thanks. It is thus that you really become their protectors and true friends of humanity;—you contribute by your labours and success to the improvement of the condition of all classes of society and are in the way of accomplishing the wishes that are dearest to my heart.

Continue in this noble career with perseverance. The exposition exhibits productions which demonstrate that you are in the good way, that is to say, that you prefer the solid and the useful to the brilliant and the tinsel, which merely seduces. By thus infusing good faith into the composition of your products you inspire that confidence which can alone give prosperity to commerce and turn the people from that deplorable mania for hoarding up, which, by absorbing a portion of

the resources of society, paralyses the means of augmenting the national wealth and of course the public prosperity. They must have confidence in your good faith and in the moderation of your prices. The nature of your products must be such that their uses may calm distrust, and convince the purchasers that they have not been deceived. The people must learn that there is no occasion for them to hoard up and to bury their riches in the earth, in order to place them in security. The actual state of civilization ought to convince them that such fears can only exist among a demi-barbarous population who know no law but force, and whose chiefs think only of appropriating to themselves the wealth and the property of their subjects.

For ourselves, we have, thank God, another mission to fulfil. It is ours to protect the rights of all, to cause the property of all to be respected, to prevent any one from touching it without the consent of the owner. The imposts regularly voted by the nation are employed in its interests, and devoted to the public wants under the supervision of its own appointed authorities. Now that we are free from any of the grand necessities of war, our public credit has risen to an extent unprecedented, and nothing restrains us in the application of our immense resources to every thing which may increase the national wealth and confirm the happiness and prosperity of France.

The statements, which have just been made by your President, which were heard with so much pleasure, are a further proof of the confidence which we ought to place in the future; it will not be stationary.

Our progress, however great it may be, will not rest where it is. To what extent will it go? I know not, and think that no one can foresee or calculate the flight which the national genius imprints upon the conquests of industry and public wealth,—those conquests by which none are despoiled, no personal rights violated, and no tears caused to be shed. This is what we desire,—this is what we are pursuing. We shall continue to respect the independence of our neighbours, as they will respect ours. The victories which France has so often attached to its flag are pledges, as certain as they are glorious, of our repose and our safety. It is by persisting in this salutary path that we shall behold our commerce and industry increasing by the stability which peace affords, and the confidence which foreign nations will place in our productions, when we furnish them frankly and loyally always satisfying ourselves with a moderate profit. They may see in our expositions the manner in which French manufacturers direct their labour. To them they will furnish an example;—to us a pleasure. I was anxious to be once more amongst you, to repeat to you how sensible I am to the testimonies of affection which I have received in the numerous visits I have made to the exposition. I regret that it is over, since I shall be deprived of the opportunities of meeting with you, of hearing you, and discoursing with you.

Recueil Soc. Polytech.

Means of Preserving Cordage, Cloth, and Nets.

Fishermen on the English coast use the following method:

For one pound of thread take tan of good quality, two pounds. Boil in a suitable quantity of water six hours.

Let the tan boil alone during the first hour in a moderate quantity of water, and then put in the stuff, adding more water and keeping up the ebullition by a great heat. The stuff should not touch the sides of the kettle.

Articles thus tanned will last many years, especially if steeped once a year when they are much used. Ibid.

To determine whether Flannel contains Cotton.

Take a given weight of the flannel, 10, 20, or 30 parts, and boil it in strong ley, or solution of potash, the flannel soon dissolves and is converted into soap, while the cotton is but slightly altered. The insoluble residue (the cotton) is washed, dried and weighed, and thus its proportion of the tissue is ascertained. Ibid.

Progress of Physical Science.

*Abstract of the Proceedings of the Physical Section of the British Association for the Advancement of Science.**

"On a Blue Sun seen at Bermuda."

On the 11th of August, 1831, this curious phenomenon was observed. Not only the sun appeared of a blue colour, but white objects, such as the sails of vessels, were similarly tinged, and the sea appeared of a dingy yellow. On the day when these observations were made at and near Bermuda, a hurricane was passing over St. Vincent. Sir David Brewster, to whom these observations were communicated by Lieut. Col. Reid, Governor of Bermuda, attributes the colour to the interposition of vapour or of vesicles of water, between the eye of the observer and the sun, and remarks that the same cause may produce other colours; he had, for instance, once observed the sun to be of a salmon colour,† in which both yellow and red were mixed with blue. The phenomenon is analagous to that of the colours in sulphate of lime and other minerals containing strata of minute cavities filled with fluids; the colours resulting from diffraction at the edges of the transparent bodies, separating media of different densities.

Results of Hourly Meteorological Observations.

These observations were made at Inverness and Kingussie, under the direction of Sir David Brewster, by competent observers, and

* From the report of the proceedings given in the London Athenæum, for Oct., 1840.

† Early in August, 1831, though I cannot now fix the date, the sun was seen of this colour for some days in succession along the Atlantic Coast. [A. D. B.]

with standard instruments. In reporting upon them, Sir David Brewster remarks, that "when these observations are compared with those made at Leith, under my superintendence for four years, with those made at Plymouth from 1832 to 1840, at the expense of the Association, and under the able superintendence of Mr. Snow Harris, and with those made at Padua, Philadelphia,* and in Ceylon, we perceive very distinct traces of meteorological laws, of which no idea had been previously formed; and I have no hesitation in stating that when this class of observations are multiplied and extended, they will lead to general results of as great importance in predetermining atmospherical changes, as those which have enabled the astronomer to predict the phenomena of the planetary system."

The mean value of the interval between the times of the morning and evening temperatures which correspond to the mean of the day, deduced from the average of nine stations, is eleven hours and five minutes.

The curious result is derived from these meteorological observations that the periods of calm and of minima of temperature correspond to each other, and that the force of the wind depends on the average elevation of temperature.

Force of the Wind.

Mr. Osler, of Birmingham, communicated the results of observations on the force of the wind recorded by his anemometer,† during the years 1837, 8, and 9. It appears from the average of more than one thousand observations made for each hour of the day, that if a curve be traced to represent the mean of the force of the wind for each hour, it will be almost exactly the reverse of the curve of mean temperature for the day, not only for the whole year, but for each season.

Hourly Meteorological Observations in India.

Mr. Caldicott gave an account of the observatory erected at Trevandrum, by the Rajah of Trevancore, one of the native Indian Princes, and of the instruments already placed, and of those which he had been already authorized to place there. The hourly meteorological observations have been made since June, 1837.

The registers of the barometer give the times of maxima of daily pressure between the hours of 9 and 10, A. M. and P. M., and of minima between 3 and 4, P. M. and A. M.

Fall of the barometer	between	10 A. M. and 4 P. M.	0.109	inch.
Rise	"	" 4 P. M. and 10 A. M.	0.108	"
Fall	"	" 10 A. M. and 4 A. M.	0.071	"
Rise	"	" 4 A. M. and 10 A. M.	0.073	"

* At Frankford Arsenal, under the direction of Captain Mordecai. See this journal, vol. xix. p. 7.—[A. D. B.]

† One of these admirable instruments has been mounted, under my charge, in the Philadelphia Magnetic Observatory, and its registers preserved since June, 1840. [A. D. B.]

Tides in the German Ocean.

The curious feature shown by the Rev. Prof. WHEWELL, in his map of co-tidal lines, in regard to the tides of the southern parts of the German ocean, is stated by him to have been recently confirmed by observation. He had found that the tide wave there, must have a rotary motion, traveling southwards along the coast of Norfolk and Suffolk, England, then crossing over to the coast of Holland, and traveling along that coast from south to north. Hence it follows that at a certain point of the sea between England and Holland there is *no tide*, the surface neither rising nor falling. Capt. HEWITT, in his recent survey of the German ocean, has found a place where the rise and fall in the twenty-four hours is so small that it may be considered as not existing.

Photogenic Drawing.

Professor SCHÄFTHAEUTL, of Munich, described his mode of obtaining photogenic drawings resembling those of Mr. TALBOT, where the lights are represented by shadows, and also two new methods of procuring drawings similar to those of the Daguerreotype, in which the lights and shades are represented as in nature. The first is on paper, prepared as follows. A concentrated solution of nitrate of silver is made by dissolving 140 grs. to 2½ drachms of fused nitrate in 6 fluid drachms of distilled water, and placed in a large dish, and the paper drawn over the surface of the solution. The nitrate taken up by the paper is converted into chloride by exposure to the vapour of boiling muriatic acid. This chloride has a peculiar silky lustre. The sensibility of the paper is increased to the highest point possible by again drawing it over the surface of the solution of the nitrate of silver and then drying. To fix the drawing obtained upon this paper, it is steeped for five or ten minutes in alcohol, the superfluous moisture removed by blotting paper, and then slightly dried before the fire. It is next drawn through diluted muriatic acid, to which a few drops of acid nitrate of mercury have been added; well washed in water, and dried at a temperature of about 158° Fah. The addition of the nitrate of mercury requires great caution, because if added in too great quantities the lightest shades disappear entirely; hence the proper action of the solution should be ascertained by trial upon small slips of prepared paper, which have been exposed to light.

To obtain the second kind of drawings above referred to, Dr. Schafthaeutl employs one or other of the following means. The paper which has just been described is allowed to darken in a bright sun light, and is then steeped for at least half an hour in a solution made by adding one part of the solution of the acid nitrate of mercury to nine or ten of alcohol. A bright lemon-coloured precipitate is thrown down, and the clear liquid is preserved for use. The paper which has been thus steeped is removed from the alcoholic solution and quickly drawn over the surface of dilute muriatic acid, prepared

by adding one part of strong acid to seven or ten of water, then quickly washed in water, and slightly and carefully dried in a temperature not exceeding 212° Fah. The paper is now prepared for bleaching by light, and the drawing may be fixed by steeping in alcohol which removes the free bi-chloride of mercury. This last maceration must not be continued too long, as in that case the paper begins to darken again.

On the decomposition of Glass.

Sir David Brewster finds by the application of refined optical experiments, that glass is subject to two kinds of decomposition. In the first the decomposition commences in joints and extends itself either in planes so as to form thin films, or in concentric coats so as to form concentric films. When the centres of decomposition are near each other, the concentric films, or strata which they form, interfere with each other, or rather unite, and the effect of this is that the glass is decomposed in films of considerable irregularity, their surfaces having a finely mamillated appearance, convex on one side and concave on the other. These films afford, by transmitted light, colours of infinite beauty and variety, surpassing any thing produced by art. They separate the compound solar spectrum, sifting, as it were, the mixed colours, as is done by coloured and absorbing media. In the other kind of decomposition the silicious and metallic components of the glass are separated, the particles of silex arranging themselves around the centres of decomposition, in alternating spheres with the metallic particles.

Preservation of Glass.

M. Lamont, director of the Observatory of Munich, states that the surface of glass lenses and prisms may be effectually preserved from the spots resulting from superficial decomposition to which it appears that Fraunhofer's glass is particularly subject, by rubbing the surface frequently with the finer parts of whiteing prepared by working a mass of whiteing in water, the fine powder thus obtained being used on old and soft linen.

Quantity of Rain at different Heights.

Professor Phillips found in a series of experiments continued from June 1st to September 3d, inclusive, that the quantity of rain collected at heights above the ground, increased by three feet at a time up to twelve feet, diminished on the average with the increase of height.

New Rain Gauges.

Professor Phillips has invented a gauge for measuring the direction from which a rain comes and the inclination of the drops. It con-

sists of five equal receiving funnels and tubes; one with a vertical tube and horizontal aperture, the other four tubes secured so as to present the funnels in four vertical planes, directed to four different quarters of the horizon. The quantities collected in the different gauges being compared, show the direction as well as the inclination of the rain.

Doctor Robinson, of Armagh, has made use of a ball to receive rain, which then descends along a capillary stem connected with the ball to a reservoir.

Remarkable Falls of Rain.

Professor Forbes gives the authority for his statement, that thirty-two inches of rain had fallen within twenty four hours at Genoa, a result which had been doubted. He also refers to a fall of twenty-nine inches and three lines (French) in twenty-two hours at Joyeuse, in France, of fourteen and a half inches in eighteen hours at Viviers, of six inches in three hours at Geneva, of four-fifths of an inch in half an hour at Perth, and of nine-tenths of an inch of hail and rain in twenty-seven minutes at Naples.*

Storm of January 6th, 1839.

Mr. Espy presented the chart of a storm which occurred in Great Britain at this period, to illustrate his position, that in all storms the wind blows inward towards the central parts, towards a point if the storm be round, and towards a line (the longest diameter,) if the storm be oblong. On the occasion above referred to, it appears that during the night, while a violent gale was blowing from the N. W. in the north western parts of the Island of Great Britain, the wind in the south-western parts was from the S.W., in the south eastern from the S.E. and S.S.E., and in the middle changed almost at the same time from the S.E. to the S.W., the change taking place about two hours sooner on the western than on the eastern side of the Island, in the central parts, and much sooner in the northern than in the southern, the storm traveling to the S. of E.†

Professor Ehrenberg's Microscopical Discoveries.

The want of numerous and varied forms of silicious infusory animals in the chalk previously noticed by the author, has now disappeared, and, in its place, great abundance has presented itself.

In all, the author has observed seventy-one different microscopic calcareous and silicious species of animals in the chalk; but, besides these,

* Mr. Benjamin Dwight records that at Catskill, New York, on the 26th of July, 1819, fifteen inches of rain fell between half past five and eleven P. M. The violence of the rain was over at nine o'clock.—[A. D. B.]

† For the papers giving an account of Mr. Espy's theory which he proceeded to develope, see this Journal vols. xvii, xviii, xix. [A. D. B.]

also numerous larger calcareous animals (1-24th of a line in size) and many included plants, Tethyæ, Sponges, Confervæ, and Fuci. The varied forms of the genera *Rotalia*, and *Textularia* of the Polythalamiæ, appear to him to constitute the great mass of the chalk of all localities. He reckons altogether seven genera and twenty-two species of polythalamic microscopic calcareous animals; and, moreover, microscopic and larger nummulites, cypridæ, &c. Further, he has hitherto determined forty species of siliceous infusory animals which belong to fourteen genera, without including the eight forms previously enumerated, and which were probably soft, and merely included in flint. He has found five species of plants containing silica. In the flints of the Jura limestone of Cracow, he detected well preserved peculiar Polythalamiæ, and remains of Sponges or Tethyæ; and lately, he has found Polythalamiæ of the chalk in the flints occurring in the gault which lies under the chalk at Cambridge in England.

A general table of these relations of the animals from the chalk and chalk-marl of the fourteen localities observed by him, and also specimens of the rocks, together with a collection of well-preserved microscopic preparations, containing nearly a perfect series of the different species of animalcules, were exhibited to the Royal Prussian Academy.

To this paper Professor Ehrenberg added a preliminary summary of his examination of the Spiral-corals or Polythalamiæ, considered in a zoological point of view. Edinburgh Philos. Jour.

NOTICES FROM THE FRENCH JOURNALS. TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE. BY J. GRISCOM.

Account of a Whirlwind, accompanied by immense Electrical discharges, in the commune of Chatenay. By M. PELTIER.

M. Peltier gave an account of a whirlwind (trombe,) which devastated the commune of Chatenay (Seine-et-Oise,) on the 18th of June last, the cause of its formation, its origin, its progress, deviations, effects and termination. After mentioning the persons who accompanied him in the examination of the region of the storm, and of the numerous persons who had witnessed it, he says:

Early in the morning a storm had gathered to the south of Chatenay, and by ten o'clock had advanced into the valley between the hills of Econen and the mount of Chatenay. The clouds were pretty high, and having extended over the village, they stopped, and the storm appeared likely to spend itself in the plain at the west, covering Chatenay only by its eastern extremity. The thunder rolled, and this first gust followed the commune track, when about noon a second gust arose also in the south, and rapidly advanced up the same plain. When it reached the extremity of the plain over Fontenay and had attained a position near the first gust which towered above the second by its greater elevation, it was arrested, and the spectators were left in doubt with respect to the direction it would be obliged to take. The thunder was heard from this second storm, when suddenly one of its lower clouds descended to the earth, and all explosion appeared to cease. A prodigious attraction now took place. All the light

bodies on the surface of the ground flew up with the dust to the point of the cloud; a continual rolling sound was heard, little clouds fluttered and whirled round the inverted cone, ascending and descending rapidly. One observer, favourably situated, saw the cone ending below in a cap of fire, while another who was on the very spot enveloped in the whirlwind of dust saw nothing of the fire. The trees situated on the south-east of the whirlwind were attacked by it on their north west side which faced it; the other half or side was preserved from its violence. The exposed side of each tree was much blasted, while the other portion retained their sap and vegetation. The whirl descended the valley to the extremity of Fontenay, and tearing up and destroying some trees which grew on the borders of a brook, which, though without water, was still moist, it crossed the valley and destroyed another plantation of trees. Here it stopped a few minutes (one person said ten minutes) as if uncertain which way to proceed, having attained a position beneath the first thunder clouds, which, though till then stationary, began to move, being repelled by the whirlwind, retrograded down the valley to the west of Chatenay. The storm closed, arrested as we have said, over the plains of Thibaust, after drying up, destroying and devastating this whole plain, advanced to the park of the Castle of Chatenay, overturning every thing on its way. Here on the mount it filled with desolation one of the most delightful habitations in the vicinity of Paris. The park lost all its finest trees. The newest plantations just beyond the verge of the storm, are all that remain; the walls were thrown down, the castle and the farm house lost their roofs and chimneys, trees were transported to the distance of several hundred yards, while rafters, staffs, tiles, &c., were carried more than five hundred. Passing from the mount, the tempest stopped over a pond, tore up and destroyed one-half of the trees, killed all the fish, moved slowly along an avenue of willows, whose roots extended into the moist ground; losing, in this place, much of its extent and violence, it advanced still more slowly along the plain, and at a thousand yards from Chatenay, near a grove of trees, it divided into two parts, the one rising into the upper regions of air, and the other becoming extinct near the surface.

In this too rapid statement, continues M. Peltier, I have designedly omitted to speak of the condition of the trees. All those which were struck by the storm presented the same appearances. Their sap was all evaporated, the ligneous fibres had lost their cohesion, and were dried up, as if they had been exposed for forty-eight hours in an oven to a heat of 300° Fah. Not a vestige of moisture remained. This immense quantity of vapour, instantly disengaged, could be liberated only by breaking the trees to pieces, and exposing all their vessels, and as the ligneous fibrils were less coherent in this longitudinal and then horizontal direction, the trees were all split into lath throughout a portion of their trunks. Fifteen hundred feet attested that they had served as conductors to masses of electricity, to continual and incessant strokes of lightning, and that such an elevation of temperature was produced by this continuous electric current as to vaporise almost instantly the whole of the moisture of these vegetable conductors.

This immediate vaporisation caused the wood to split longitudinally, and the trees, when dried, split and converted into bad conductors, were by the agitation which accompanied the storm, broken to pieces instead of being torn up by the roots.

In tracing the progress of this phenomenon, we witness the transformation of a common storm into a whirlwind. We perceive two storms near each other, the one above motionless, the other below presenting itself by clouds charged with the same electricity, the first storm repelling the other toward the ground, the clouds at the head of the second lowering and communicating with the ground by whirlwinds of dust and by trees. Thus connected, the noise of the thunder immediately ceases, the discharges occurring through the descending clouds and the trees of the plain. The latter becoming the channels of the electric current, are so heated that their sap is instantly reduced to vapour, and the trees are lacerated by the tension. Flame balls, and sparks of fire, accompanied the meteor. The odour of sulphur was perceived on some of the houses for several days, and curtains even changed in colour. Every thing tends to prove that the whirlwind was only a cloudy conductor; serving as a passage for the continuous discharges of the upper clouds; and that there is no other difference between a common thunder gust and a gust accompanied by a whirlwind, than this additional conductor which conveys the whole action of the storm to the point between the whirlwind and the ground beneath.

L'Institut p. 290.

Account of a Storm near Brussels, on the 4th of June, 1839. *By* M. Quetelet.

A storm occurred on the 4th of June, 1839, in the vicinity of Brussels, in which, according to M. Quetelet, so much rain fell as to produce an inundation, which caused the death of thirty-nine persons. It is thought the devastation must have been occasioned by a water spout.

The quantity of rain collected at the observatory at Brussels, on that day, was 112.78 millemitres, (4½ inches) which is one sixth of the quantity which fell annually at that place. So great a quantity of rain was never known before to fall at once. The most copious rain before recorded, in twenty-four hours, was on the 7th of July, 1833, the quantity being 50.27 millemitres. This last storm lasted but three hours. The barometer stood at 747.40 min. = 29.43 inches.

M. Quetelet describes a halo which appeared on the 2nd of June, at Brussels, accompanied by parhelia. It continued from half-past eleven until evening. Its colour was of a deep greyish blue, and the radius measured, about six o'clock, 22° 27′. M. Willaert, Professor at Alost, saw the primitive halo separate into two parts, the interior one being very well formed, the exterior very faint. The radius of the small circle was 22° to 20°, and that of the larger about double.

At the same time, two parhelias were formed on the circumference of the interior circle. One of the sun's images was on the southern extremity, and the other on the northern of the diameter, which passed

through the sun. The southern image emitted groups of luminous rays, which, at intervals, had the appearance of a luminous cross.

Ibid p 286.

Rupture of a Chain by Lightning.

The Hotel of the Invalides at Paris, was struck by lightning, and according to M. Bugnot, the inspector of the buildings, a chain which had served as a portion, at least, of the conductor, in consequence of having been wound round an iron support, in order that its weight might not bear too hard on the sustaining point, was broken by the lightning, and the fluid passing off on a tangent, struck the building so violently as to throw off enormous stones to the distance of eighteen or twenty yards. This fact indicates the propriety of avoiding, in all lightning rods, turns or inflexions of too sharp an angle. Similar facts, it appears, are mentioned by some ancient authors. Ibid.

Progress of Civil Engineering.

Notes on Artesian Wells and Well Boring in France.

FROM FRENCH PUBLICATIONS.

M. Champoiseau has communicated to "the Academy of Sciences," the result of the experiments which he made at Tours, to ascertain the relation which existed between the water of his artesian well, and that of the neighbouring rivers. These experiments were continued for more than three months (March, April and May), and did not show any variation in the produce at any time, whatever were the variations in the rivers round Tours, or in the tides; neither was the limpidity of the water at all affected. Indeed the apparatus did not exhibit any sensible change in the well water, and the conclusion drawn is that the artesian wells of Tours, from the great elevation of their feeding springs, are not exposed to the irregularities observed elsewhere.

A singular circumstance recently occurred during the construction of the Left Bank Versailles Railway, near Val de Fleury, varying in its operation, and its treatment, from some similar instances, which occurred on the London and Birmingham, and other railways here. A large embankment was in progress to join the viaduct then building, but the deposit of earth had scarcely begun when an extraordinary motion was communicated to the adjoining soil. In two places it was lifted up eight or ten yards above the surface, the road was blocked up, and several houses on the disturbed site were upset. It was found that this operation proceeded from a stratum of clay, mixed with sand, and soaked with last year's rains, so as to become fluid; that the weight of the embankment, thirty yards high, and that of the superincumbent strata had put this pulpy mass in motion, and that it had disturbed the adjoining soil on the slope of the valley, and had in several places lifted up and broken through the upper strata. The

cause was apparent that water did the mischief, and though it might nòt have shown itself immediately if the season had been dry, yet ultimately it would have been productive of serious evil. To remedy this, there were no other means than to stop the flow of water arriving from the upper levels; to carry which into effect it was necessary to cut the clay stratum and replace by stone work, which would surround the site on which the embankment was to be formed, and divert the water. This operation was found exceedingly difficult, having to be carried on at a depth of from six to twenty yards in a moving soil, saturated with water; it was long, very dangerous, and an accident might have wasted much valuable time, the works of the embankment being suspended in the meanwhile, and the stone-work itself being liable to be swallowed up in a few years, and the work to be done over again.

Under these circumstances, the engineers thought it advisable to have recourse to boring for the purpose of absorbing the water, and applied to the General Well-boring Company at Paris. This mode was also difficult, as the boring tube got plugged up in the soft stratum as fast as it was emptied, but by means of good tools this was at last got over. The first boring reached twenty yards, and got into the upper part of the chalk, notoriously full of fissures, and where the water was rapidly absorbed. The second and third borings were carried to thirty-five and forty yards in order to get at the chalky fissures which communicate with the Seine, and feed the neighbouring wells. A series of borings will therefore be carried round the embankment at proper distances and drains if necessary made to carry the water into the borings, which can easily be kept clear by means of a valve and cord. It is proposed also to apply this method to get rid of the water in sand, but this necessarily depends on the strata, for we believe that in the Kilsby tunnel it would not have been practicable.

Civ. Eng. and Arch. Jour.

Improved Railway Wheels.

Mr. Dircks, of Liverpool, gave an account of his improved railway wheel. The wheel may be made either of wrought or cast iron—that exhibited in the model room is of cast iron, and is one of the set of four wheels, which have run daily on a railroad for the last two months, carrying an average load of five tons, and are considered, by competent judges, to be better, if any thing, now than the first day they were put on the road. The construction of the wheel will be understood by imagining an ordinary spoked wheel, but with a deep *channeled* tyre. In this channel is inserted blocks of African oak, measuring about four by three and a half inches—prepared by filling the pores with unctuous preparations, to render it impervious to wet or dampness, by thus counteracting the effects of capillary attraction. The blocks are cut so as to fit very exactly with the grain placed vertically throughout, forming a kind of wooden tyre. There are about thirty blocks of wood round each wheel, where they are retained in their

place by bolts—the two sides of the channel having corresponding holes drilled through them for this purpose—each block of wood is thus fastened by one or two bolts, which are afterwards well rivetted. After being so fitted, the wheel is put into a lathe, and turned in the ordinary manner of turning iron tyres, when it acquires all the appearance of a common railway wheel, but with an outer wooden rim, and the flange only of iron. Mr. Dircks proposes the use of either hard or soft woods, and of various chemical preparations, to prevent the admission of water into the pores of the wood; he also contemplates the using of wood well compressed. The several advantages which this wheel possesses are represented by him to be—that the wooden tyre will wear a considerable time without requiring any repair—that the tyre can be refaced by turning it up again in the lathe, as with worn iron tyres—that it can be retyred with wood, at little expense, and at a far less loss of time than usual—and that, both in the operations of refacing old tyres, or putting in new wood, the work can be performed without the usual labour and cost of removing the wheels from the axles, which, in keying and unkeying, is known to be very troublesome. In regard to their working, it is an opinion, in which Mr. Dircks said he was borne out by experiment as well as by the opinion of practical engineers, that it will work smoother and easier than iron tyred wheels, with the advantage of going well in wet weather and upon inclines—entirely obviating the necessity of dropping sand on the rails. One very important advantage yet remains, and that is, that the rails themselves will suffer less wear by using these wheels, and the fastenings, sleepers, and blocks not be so much injured; indeed, if they answer to the extent that seems to be with reason expected, it is possible that they will have the effect to bring cast iron wheels into more general use.

It is well known that a road laid on stone blocks is kept up at a lower rate than when laid on wooden sleepers, and the only reason for laying them aside, arises from the tremulous motion which iron wheels occasion on the rails. In most cases stone blocks are still used, where they can be applied with safety, in preference to wooden sleepers. On the Kingstown and Dublin Railway, the rails were originally laid on granite sleepers, but the tremulous motion just adverted to was so great, and likely to prove so disastrous, by loosening the rails, together with the consequent damage sustained by engines and carriages passing along the line, that they were ultimately all taken out to lay down longitudinal wooden sleepers. Now, there is every reason to believe, that in all such cases, the effect of these wood-tyred wheels would be, by obviating this injurious tremulous motion, to favour the continued employment of stone blocks in the laying of railways—an advantage, upon the importance of which, as being well understood, it will not be requisite to enlarge here. This new construction and simple adoption of wood makes excellent driving-wheels for locomotives. The wood by use becomes exceedingly close and firm, acquires a smooth surface, does not prevent the ringing of the wheels when hammered, and in outward appearance is not easily distinguished from metal.

Mining Review.

New System of Lockage for Canals.

To avoid the present expensive construction of locks and their waste of water, Mr. Smith, of Deenston, proposes to divide the canal into a series of basins, the water levels of which should be from 12 to 18 inches above each other. The extremity of each basin is so constructed as to permit only the free passage of a boat; in this is placed a single gate, hinged to a sill across the bottom, the head pointing at a given angle against the stream, and the lateral faces pressing against rabbets in the masonry. The gate is to be constructed of buoyant materials, or made hollow so as to float and be held up by the pressure of the water in the higher level; on the top is a roller to facilitate the passage of the boats. When a boat is required to pass from a higher to a lower level, the bow end, which must be armed with an inclined projection, depresses the gate as much as the depth of the immersion of the boat, and as much water escapes as can pass between its sides and the walls of the contracted part of the basin. The same action takes place in ascending, except that a certain amount of power must be expended to enable the boat to surmount the difference of level between the basins. The quantity of water wasted by each boat would be in proportion to its immersion and the speed at which it passed over the gate. In case of different sized boats passing along the same canal, it is proposed to have a small gate forming part of the main gate, so as to avoid the loss of water which would ensue from the whole width being open for the passage of a small boat. This system has only been tried by models; but it is proposed to make an essay on an extensive canal next summer, when the results will be communicated to the Institution.—*Trans. of Inst. Civ. Eng.* Mech. Mag.

Draining the Haarlem Lake.

M. Dietz, a celebrated Dutch engineer, has invented a machine which it is supposed will be adopted for this purpose, and by means of which he calculates that 100,000 cubic ells of water may be drained off daily. This ingenious person estimates the body of water contained in the Haarlem Sea, at 770,000,000 of cubic feet, to empty which it would require ten of his machines of 30 horse power each, the quantity drained off by them daily being 1,000,000 of cubic feet, thus making the period required for its entire removal 800 days. The estimated expenditure of this work, second only in grandeur and importance to the Thames Tunnel, is as follows:—

	Florins.
Ten machines, at 30,000 florins each	300,000
Coals, &c., 500 florins per diem for 800 days	400,000
Sixty workmen at 1½f. each per diem for 800 days	72,000
Superintendence, plans, &c.	25,000
Total, - - - -	797,000
About - - - -	£68,416

Report on a Pantograph, presented by M. LEGEY. *By* M. FRANCŒUR.

The pantograph is an instrument of the greatest utility in reducing drawings to smaller dimensions, and it is sometimes used in amplifying them or in copying them of the same size. But the uncertainty of the adjustments prevent entire confidence in the precision of the designs thus executed; and this instrument is rarely employed in cases where it is indispensable that the lines should be extremely accurate in this relation, particularly when the drawings are on a large scale.

The pantograph of M. Legey has the same form, and is founded on the same principles as those in common use; only he has applied to its execution all the care which his previous labours have rendered him so capable of. It would be too tedious to enter here upon all the details of the minute perfections to which he has brought its construction; we shall designate only the principal parts.

The branches of the instrument are not flat rulers in wood or brass, as heretofore, but tubes, bench drawn, which give to the system more lightness and solidity. These branches can no longer bend under their weight. Screws of adjustment render the plane of the instrument exactly parallel to that of the table which bears it. The rollers are disposed so as to support the instrument in the best manner in all its movements. The axis round which the principal points of junction are pivoted, though solidly arranged, are susceptible of receiving slight displacements in order to regulate the instrument; for we know that the branches must rigorously form a parallelogram in all their positions, and that the fixed points round which the rotation is made must be precisely on the right line passing through the pencil and the stylet which traces the drawing. The author has also designed to allow of slight movements to certain supports of the stylet and the crayon, in order that the straight line, either in one direction or the other, should be perpetually preserved; for we know that the precision of the result depends essentially on these conditions.

In conclusion, the pantograph of M. Legey appears to us to be executed with care, and formed upon the best principles. It is, moreover, of such large dimensions, that it has served to reduce the plan of the city of Arras, and produce a drawing of a metre and a half in width. The most favourable testimony has been furnished us in this respect by Captain BICHOT, of the Engineers who performed the work.

Signed, FRANCŒUR, Reporter.

Bull. d'encour. Nov. 1839.

Mechanics' Register.

New Post Office Regulations in England.—Seeds sent by Post.

We have lately received not only seeds, cuttings, and scions, but even entire plants, and yesterday a shrub, roots and branches, (Vac-

cinium humifúsum), in a penny letter. From Messrs. Sang, of Kirkcaldy, we received a prepaid packet very neatly done up, containing the seeds of twelve kinds of annuals, each with the name printed, and the price of the whole twelve only 1*s*. If this does not lead to the general distribution of every useful and ornamental plant of which seeds are procurable, the fault will be in the public, not in government. We only wish that the foreign postages could be lowered a little, that our ornamental annuals might be sent all over the Continent; for, it is a fact that will not be denied, that annual plants, even those of warm climates, make a far more splendid appearance in Norway, Sweden, Russia, and the North of Germany, than they do in England, owing to the brighter sun and longer days of these countries during the summer season. Great part of the Californian annuals might be naturalised in the woods of Norway and Sweden, and many superior varieties of bread corn, and of pasture grasses and herbage plants, might be introduced into these countries by post, if the postage abroad were only a little lower. An interchange of seeds amongst all the curators of botanic gardens in Europe and America is a result to be anxiously desired, not merely by the botanist, but by the horticulturist and the farmer. If ambassadors were what they ought to be, matters of this kind would have been attended to long ago.—*Cond.*

Gard. Mag.

Southern Magnetic Expedition.—Extract of a Letter from an Officer of H. M. S. Erebus, 7th February, 1840.

"On the 20th November, we left Porto Praya, and December 2nd and 3rd examined and took observations on a cluster of rocks called St. Paul,—evidently the summit of a submarine peak. The sea would make a clear breach over them in blowing weather, consequently nothing vegetable is found. The geological specimens will prove interesting; their general character plutonic, with blue lava and conglomerate. Crabs and sea birds were breeding, and the rocks are quite white with the dung of the latter.

"December 17th we landed on Trinidad, to make magnetic observations, and December 24th we crossed the magnetic equator, in latitude 14° 1′ S, after which in the teeth of a S. E. trade, we worked up to St. Helena, having completed a chain of dips from England to that place.

"Perhaps the most interesting of our achievements will be the fact of our having gained bottom, at two thousand four hundred and twenty six fathoms, in latitude 27° 24′ S. longitude 17° 30′ W., both ships being becalmed on the edge of the S. E. trade. A line of 3600 fathoms of spun-yarn being prepared, a weight of 72 lbs. was attached to it, and two boats were lowered to buoy up the line. The first 100 fathoms took 35 seconds reeling off,—the last nearly 6 minutes; we lifted the lead more than once, but of course the spun-yarn broke in the attempt to haul it up."

Naut. Mag.

To the Committee on Publications of the Journal of the Franklin Institute.

GENTLEMEN,—Mr. John Downes, of Worcester, Mass., having kindly offered to make the computations for the announcement of the Lunar Occultations of the fixed stars for the year 1841, I herewith forward you those for February, March and April, which have been calculated by Mr. Downes from a list selected by E. O. Kendall and myself. Mr. Downes is already favourably known as the computer of the Astronomical portion of the Boston Almanac. It is almost needless to add that his computations of the Lunar Occultations for January and February for Philadelphia agree precisely with those made for the same phenomena by Mr. Kendall and myself. As our other avocations render somewhat onerous the labour of making the announcements, which was sustained by myself without aid from 1834 to 1836 —and since that date by Mr. Kendall and myself—our duplicate computations saving the necessity of a separate review,—we have gladly accepted the very disinterested offer of Mr. Downes, and would respectfully recommend his computations to the favourable notice of that portion of the readers of the Journal who are interested in kindred pursuits.

Yours respectfully,

SEARS C. WALKER.

Philadelphia, December 30th, 1840.

LUNAR OCCULTATIONS FOR PHILADELPHIA, FEBRUARY, 1841.
COMPUTED BY JOHN DOWNES.

Angles reckoned to the right, or westward, round the circle, as seen in an inverting telescope.
☞For direct vision add 180°.☜

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
4	16	34	Im. δ Cancri	4.5	19°	73°
4	17	13	Em.		287	340
5	18	30	Im. 18 Leonis,	6	13	64
5	19	2	Em.		294	343
			MARCH, 1841.			
1	6	0	Im. C Tauri,	4.5	142	117
1	6	26	Em.		200	169
9	14	25	N. App. ☽ & 75 Virginis 6, ☽ south 1′.1			
25	20	18.82	Im. Venus. External contact.		130	79
25	20	19.73	" " Internal "			
25	21	10.87	Em. " " "		275	221
25	21	12.82	" " External "			
26	7	42	N. App. ☽ & 7 Tauri 6, ☽ south 0′.5			
29	12	19	Im. 37 Geminorum,	6	117	176
29	13	6	Em.		210	260

LUNAR OCCULTATIONS FOR PHILADELPHIA, APRIL, 1841.
COMPUTED BY JOHN DOWNES.

Angles reckoned to the right or westward round the circle, as seen in an inverting telescope.
☞For direct vision add 180°.☜

Day.	H'r.	Min.	Star's name.	Mag.	From Moon's North point.	From Moon's Vertex.
2	8	42	Im. 48 Leonis,	5.6	104°	83°
2	9	30	Em.		181	177
13	15	47	Im. 4 Capricorni,	6	154	120
13	16	50	Em.		247	225
14	8	58	Im. θ Capricorni,	5.6	67	116
			Em. below the horizon.			

Meteorological Observations for November, 1840.

Moon.	Days	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inch's	Inch's			Inches.	
	1	36	52	30.00	30.05	W.	Moderate.		Clear—do.
	2	39	52	.20	.26	N E.	do.		Clear—do.
	3	36	56	.20	.08	E.	do.		Clear—do.
	4	46	59	29 98	29.98	N.E.	do.		Hazy—do.
	5	39	58	.95	.90	N. E.	do.		Hazy—do.
	6	41	50	.86	.86	W.	do.		Partially cloudy—do.—do.
	7	41	63	.90	.93	W.S.E.	do.		Clear—do.
☿	8	44	49	.84	.76	E.	do.	.26	Cloudy—rain.
	9	46	48	.70	.64	W.	Brisk.		Cloudy—do.
	10	48	54	.70	.76	N.W.	do.		Cloudy—clear.
	11	38	52	.90	.90	N.W.	Moderate.		Clear—do.
	12	42	52	.80	.80	W.	do.		Cloudy—clear.
	13	40	53	.75	.75	W.	Brisk.		Clear—do.
	14	34	50	.90	.85	W.	Moderate.		Hazy—do.
	15	44	44	.50	.50	W.	Brisk.		Cloudy—do.
☽	16	32	42	.75	.80	W.	Moderate.		Partially cloudy—do.—do.
	17	29	40	.75	.80	W.	do.		Partially cloudy—do.—do.
	18	32	32	.76	.50	N.E.	do.	.50	Snow—do.
	19	30	56	.56	.60	W.	do.		Cloudy—do.—do.
	20	34	40	.85	.90	W.	do.		Clear—do.—do.
	21	26	42	30.05	30 05	W.	do.		Clear—lightly cloudy.
⊗	22	36	43	29.90	29.75	S.E.	do.	1.65	Cloudy—rain.
	23	56	52	.40	.40	S.W.	Brisk.		Cloudy—flying clouds.
	24	35	46	.95	.96	W.	Moderate.		Clear—do.
	25	36	44	.90	.80	N.E.	do.		Cloudy—rain.
	26	36	40	.60	.60	W.	do.	.34	Cloudy—snow.
	27	30	37	.86	.94	W.	Brisk.	.20	Clear—do.
	28	28	44	30.05	.97	W.	Moderate.		Clear—do.
	29	36	52	29.94	.58	S W.	do.		Clear—do.
	30	46	35	.70	.65	S.W.	do.		Cloudy—hazy.
	Mean	36.77	78.55	29.81	29.79			2.95	

	Thermometer.		Barometer.	
Maximum height during the month.	60 00	on the 2nd.	30.25	on the 2nd.
Minimum " "	26 00	on the 21st.	29.40	" 23rd.
Mean	57.65		29.80	

METEOROLOGICAL REPORT

FOR THE STATE OF PENNSYLVANIA,

Collated from returns made to the Committee on Meteorology of the Franklin Institute of the State of Pennsylvania, for

JANUARY, 1841.

	County.	Town.	Observer.	Thermometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum.	Mean.	Days omitted.	Register. Lowest.	Mean.	Days omitted.	Barometer. 7, A. M.	2, P. M.	9, P. M.	Maximum.	
1	Philadelphia,	Philadelphia,	G. P. Schively,															
2	Montgomery,																	
3	Bucks,	Newtown,	L. H. Parsons,	27.39	36.39	30.58	48.00	1.00	31.45	.	0.75	24.99	.	30.10	30.09	30.11	30.78	
4	Lehigh,																	
5	Northampton,	Easton,	Charles Elliot,															
6	Monroe	Stroudsburg,	A. M. Stokes,	22.08	30.14	22.60	55.00	—16.00	29.94	11 3/5	....	....	.	29.54	29.54	29.46	30.20	
7	Pike,	Milford,	Ralph Bull,															
8	Wayne,	Honesdale,	W. Richardson,															
9	Susquehanna,	Silver Lake,	E. Rose,	18.71	26.03	21.65	42.00	—10.00	22.13	.	—10.00	18.19	.	28.06	28.05	28.02	28.35	
10	Luzerne,	Wilkesbarre,	W. F. Dennis,															
11	Schuylkill,	Port Carbon	P. C. Lyceum,	24.92	35.18	26.75	52.00	—20.50	28.95	5/6	—15.00	20.84	.	29.42	29.39	29.39	30.02	
12	Berks,	Reading,	C. F. Egelmann,	26.26	32.42	28.23	54.00	—2.00	28.97	.	...	...	.	29.89	29.85	29.87	30.50	
13	Chester,	West Chester,	Wm. W. Jefferies,	28.24	35.02	29.98	56.50	—5.00	31.08	.	—5.00	25.32	.	29.94	29.95	29.93	30.42	
14	Delaware,	Haverford,	Haverford School,	29.29	32.97	31.32	56.00	2.00	31.19	.	—1.00	23.86	2	29.61	29.56	29.59	30.16	
15	Lancaster,	Lancaster,	Conservatory of Arts,	26.69	35.25	28.88	55.00	—7.00	30.27	5/6	—7.00	23.69	.	29.51	29.45	29.49	30.15	
16	York,																	
17	Lebanon,																	
18	Dauphin,	Harrisburg,	J. Heiseley,	26.97	31.20	29.74	45.00	—2.00	29.30	5/6	—2.00	27.71	.	29.85	29.82	29.83	30.55	
19	Northumberland,	Northumberland,	Andrew C. Huston,	23.19	32.22	26.26	50.00	—21.00	27.22	.	—23.00	17.09	.	29.46	29.41	29.45	30.10	
20	Columbia,	Danville,	C. H. Frick.															
21	Bradford,																	
22	Tioga,																	
23	Lycoming,																	
24	Union,																	
25	Mifflin,																	
26	Juniata,	Mifflintown,	J. A. Kinkead,	21.52	32.85	23.83	46.00	—14.00	26.07	1 3/5	....	....	.	29.53	29.47	29.51	30.21	
27	Perry,																	
28	Cumberland,	Carlisle,	Prof. W. H. Allen,															
29	Adams,	Gettysburg,	Prof. M. Jacobs,	23.57	33.70	36.37	48.50	—10.00	27.88	.	—16.00	21.69	.	29.40	29.35	29.37	30.05	
30	Franklin,																	
31	Huntingdon,	Huntingdon,	Prof. Jacob Miller,	22.19	32.43	25.52	44.00	—16.00	26.35	1	....	....	.	29.35	29.35	29.32	29.96	
32	Centre,	Bellefonte,	John Harris,	16.76	34.17	24.26	48.00	—25.00	25.06	13	....	....	.	29.32	29.22	29.33	29.90	
33	Potter,																	
34	M'Kean,	Smithport,	M. R. Atkins,	20.74	27.97	24.19	49.00	—18.00	24.30	.	....	....	.	....	....	....	....	
35	Clearfield,																	
36	Cambria,	Ebensburgh,	Richard Lewis,	21.29	27.88	22.80	46.00	—15.00	23.99	2	—15.50	20.02	.	27.77	27.76	27.77	28.21	2
37	Bedford,	Bedford,	Samuel Brown,	23.74	35.62	27.97	51.00	—12.00	29.11	.	....	....	.	29.21	29.19	29.21	29.76	2
38	Somerset,	Somerset,	George Mowry,	26.30	32.98	27.96	48.00	—10.00	29.08	6	—10.00	23.91	8	27.76	29.76	27.76	28.10	2
39	Indiana,	Indiana,	Richard White,	29.97	33.48	27.74	50.00	—15.00	30.40	.	....	....	.	28.56	28.58	28.57	29.10	2
40	Jefferson,	Rose Cottage,	C. C. Gaskell,															
41	Warren,	Warren,	J. E. King,	31.97	35.79	28.72	54.00	2.00	32.16	1 1/2	....	....	.	28.52	28.53	28.54	29.11	2
42	Venango,	Franklin,	Wm. Connely,	22.45	33.71	25.00	55.00	—20.00	27.05	.	....	....	.	28.91	28.91	28.95	29.53	2
43	Armstrong,																	
44	Westmoreland,																	
45	Fayette,	Uniontown,	J. P. Weethee,	29.19	37.05	28.53	59.00	—24.00	31.59	.	....	....	.	28.99	28.99	28.98	29.61	2
46	Green,																	
47	Washington,	Cannonsburg,	Prof. A. H. Campbell,															
48	Alleghany,	Pittsburgh,	J. P. Bakewell,	26.50	34.78	29.50	56.00	—6.00	30.26	3	....	....	.	29.17	29.16	29.18	29.85	2
49	Beaver,	Beaver,	James Allison,	26.42	34.96	28.29	53.00	—2.00	29.89	5/6	....	....	.	29.36	29.38	29.44	30.30	2
50	Butler,	Butler,	Jacob Mechling,	28.00	33.61	31.00	50.00	—10.00	30.87	.	....	....	.	28.72	28.72	28.74	29.30	2
51	Mercer,	West Greenfield,	S. Campbell,															
52	Crawford,	Meadville,	J. Limber,															
53	Erie,	Erie,	Park & Reid,															

nometer.						Barometer.							Weather.					
			Register.															
	Mean.	Days omitted.	Lowest.	Mean.	Days omitted.	7, A. M.	2, P. M.	9, P. M.	Maximum.	Minimum	Mean.	Days omitted.	Clear.	Cloudy.	Days omitted.	Rain.	Snow.	Rain and Snow.
.00	31.45	.	0.75	24.99	.	30.10	30.09	30.11	30.78	29.36	30.10	.	7⅓	23	⅓	7	1	4
.00	29.94	11⅔	....	....	.	29.54	29.54	29.46	30.20	29.30	29.51	7⅔	5⅓	15⅔	10	3	6	...
.00	22.13	.	—10.00	18.19	.	28.06	28.05	28.02	28.35	27.60	28.04	.	7	24	.	2	8	...
.50	28.95	½	—15.00	20.84	.	29.42	29.39	29.39	30.02	29.03	29.40	½	7⅔	23	½	6	8	1
.00	28.97	.	...	...	.	29.89	29.85	29.87	30.50	29.15	29.87	.	7⅔	23⅓	.	5	5	3
.00	31.08	.	—5.00	25.32	.	29.94	29.95	29.93	30.42	29.60	29.94	.	.	.	.	5	5	4
.00	31.19	.	—1.00	23.86	2	29.61	29.56	29.59	30.16	29.08	29.59	.	9⅓	21⅔	.	....	....	...
.00	30.27	⅔	—7.00	23.69	.	29.51	29.45	29.49	30.15	28.78	29.48	⅔	9	21⅓	⅔	9	4	4
.00	29.30	⅓	—2.00	27.71	.	29.85	29.82	29.83	30.55	29.30	29.85	⅓	9⅔	21⅓	.	7	5	3
.00	27.22	.	—23.00	17.09	.	29.46	29.41	29.45	30.10	28.86	29.41	.	5	25⅔	⅓	7	7	4
.00	26.07	1⅓	....	....	.	29.53	29.47	29.51	30.21	28.92	29.50	2	5	23⅔	2⅓	3	4	1
.00	27.88	.	—16.00	21.69	.	29.40	29.35	29.37	30.05	28.81	29.38	.	10	21	.	15	2	...
.00	26.35	1	....	....	.	29.35	29.35	29.32	29.96	28.80	29.34	1	9	22	.	1	5	1
.00	25.06	13	....	....	.	29.32	29.22	29.33	29.90	28.70	29.29	12⅓	3⅔	14⅓	13	1	4	...
.00	24.30	.	....	....	.	....	....	....	....	....	....	.	8⅓	21⅓	1⅓	2	13	1
.00	23.99	2	—15.50	20.02	.	27.77	27.76	27.77	28.21	27.22	27.77	2	2	20	9	....	....	...
.00	29.11	.	....	....	.	29.21	29.19	29.21	29.76	28.67	29.20	.	7	24	.	....	....	...
.00	29.08	6	—10.00	23.91	8	27.76	29.76	27.76	28.10	27.30	27.76	6	2⅔	22⅓	6	2	9	...
.00	30.40	.	....	....	.	28.56	28.58	28.57	29.10	28.00	28.57	.	6	25	.	8	7	...
.00	32.16	1⅔	....	....	.	28.52	28.53	28.54	29.11	28.10	28.53	1⅔	3	26⅓	1⅔	....	....	...
.00	27.05	.	....	....	.	28.91	28.91	28.95	29.53	28.45	28.92	1	4⅔	25⅓	1	3	2	...
.00	31.59	.	....	....	.	28.99	28.99	28.98	29.61	28.56	28.99	.	9	22	.		6	...
.00	30.26	3	....	....	.	29.17	29.16	29.18	29.85	28.18	29.17	1⅓	5⅔	24⅓	1	8	2	3
.00	29.89	⅔	....	....	.	29.36	29.38	29.44	30.30	28.76	29.39	⅔	5⅔	24⅔	⅔	4	5	1
.00	30.87	.	....	....	.	28.72	28.72	28.74	29.30	28.20	28.73	.	7	24	.	3	8	...

Weather.					Winds.																	Hygrometer.					
Rain.	Snow.	Rain and Snow.	Thunder Showers.	Rain in inches.	North.	N. N. E.	N. E.	E. N. E.	East.	E. S. E.	S. E.	S. S. E.	South.	S. S. W.	S. W.	W. S. W.	West.	W. N. W.	N. W.	N. N. W.	Calm.	Days omitted.	Dew-point.	Days omitted.	Diff. therm. and dew-point.	Wet Bulb.	Days omitted.	No. of Report.
7	1	4	..	7.037	1	$\frac{1}{3}$	9	$\frac{1}{3}$	.	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	.	6	$1\frac{1}{3}$	$1\frac{1}{3}$	2	$6\frac{1}{3}$	.	$\frac{1}{3}$	$1\frac{1}{3}$	....	.	.....	....	.	1395
3	6	....	..	3.591	$1\frac{1}{3}$	.	$2\frac{2}{3}$	$\frac{1}{3}$	4	.	.	.	1	.	$3\frac{2}{3}$	$1\frac{2}{3}$	$5\frac{2}{3}$	$\frac{1}{3}$	2	.	.	$8\frac{1}{3}$	....	.	.....	....	.	1353
2	8	....	..	1.591	$5\frac{2}{3}$	.	.	.	.	.	.	.	.	.	8	$\frac{2}{3}$	10	$\frac{1}{3}$	$6\frac{2}{3}$	.	.	.	....	.	.....	....	.	1403
6	8	1	..	.....	.	$\frac{1}{3}$	$5\frac{1}{3}$	$2\frac{1}{3}$	$1\frac{1}{3}$	$1\frac{1}{3}$	$\frac{1}{3}$	.	$\frac{1}{3}$	.	3	$\frac{1}{3}$	$6\frac{1}{3}$	2	$3\frac{1}{3}$	.	$4\frac{1}{3}$	$\frac{1}{3}$	....	.	.....	....	.	1362
5	5	3	..	.....	$\frac{1}{3}$	.	$1\frac{1}{3}$	$\frac{1}{3}$	6	$\frac{1}{3}$	$5\frac{2}{3}$	.	.	.	$4\frac{1}{3}$	.	$2\frac{2}{3}$	$1\frac{1}{3}$	$9\frac{2}{3}$	.	.	.	....	.	.....	....	.	1350
5	5	4	..	.....	$2\frac{2}{3}$	$1\frac{1}{3}$	$5\frac{2}{3}$	.	1	$\frac{1}{3}$	2	$1\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$3\frac{1}{3}$	.	3	.	$7\frac{1}{3}$	2	.	.	....	.	.....	....	.	1344
...	....	....	..	4.613	$\frac{1}{3}$	1	$5\frac{2}{3}$	$1\frac{1}{3}$	.	.	$3\frac{2}{3}$	.	$\frac{1}{3}$	$1\frac{1}{3}$	3	$\frac{1}{3}$	$\frac{1}{3}$	3	$8\frac{2}{3}$	$1\frac{2}{3}$	$\frac{1}{3}$	.	37.35	5	.....	....	.	1348
9	4	4	..	6.430	$1\frac{2}{3}$	$\frac{2}{3}$	$4\frac{2}{3}$	$2\frac{1}{3}$	$1\frac{2}{3}$	.	$1\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$	$\frac{2}{3}$	$3\frac{2}{3}$	1	$4\frac{1}{3}$	$1\frac{1}{3}$	$3\frac{1}{3}$	$1\frac{2}{3}$	.	$\frac{2}{3}$	25.45	1	.....	32.63	1	1370
7	5	3	..	... ...	$1\frac{1}{3}$	.	$3\frac{1}{3}$	.	$1\frac{1}{3}$	.	$12\frac{2}{3}$	.	$\frac{1}{3}$	.	.	.	$\frac{1}{3}$	.	$11\frac{1}{3}$	.	.	$\frac{1}{3}$	....	.	.....	....	.	1345
7	7	4	..	5.236	$3\frac{1}{3}$	.	$4\frac{2}{3}$	.	2	.	$2\frac{2}{3}$	1	2	.	$1\frac{1}{3}$	.	$7\frac{2}{3}$	$\frac{1}{3}$	$2\frac{1}{3}$	.	4	.	....	.	.....	....	.	1343
3	4	1	..	3.620	.	.	3	.	$\frac{1}{3}$	.	1	.	.	.	$\frac{1}{3}$	.	$1\frac{2}{3}$	.	$5\frac{2}{3}$	.	$17\frac{1}{3}$	$1\frac{2}{3}$	....	.	.....	....	.	1346
15	2	....	..	6.353	$4\frac{1}{3}$	$1\frac{1}{3}$	$2\frac{2}{3}$	.	$\frac{2}{3}$	.	1	.	2	$1\frac{1}{3}$	3	$\frac{1}{3}$	$4\frac{2}{3}$	$\frac{2}{3}$	1	.	3	.	18.50	7	.....	28.70	7	1375
1	5	1	..	2.543	.	.	.	.	$7\frac{1}{3}$	.	.	.	.	.	.	.	$22\frac{2}{3}$	.	.	.	.	1	....	.	.....	....	.	1367
1	4	....	..	.....	1	.	$1\frac{1}{3}$	.	.	.	.	$\frac{1}{3}$	.	.	$\frac{2}{3}$	.	$4\frac{2}{3}$	.	1	$\frac{2}{3}$	$\frac{1}{3}$	21	....	.	.....	....	.	1371
2	13	1	..	4.600	1	.	$\frac{2}{3}$	.	$5\frac{1}{3}$	.	$4\frac{2}{3}$	.	3	.	6	.	7	.	$2\frac{1}{3}$	.	.	$1\frac{1}{3}$	....	.	.....	....	.	1368
...	....	....	..	.....	.	.	.	.	3	.	$5\frac{1}{3}$	.	$1\frac{1}{3}$	$\frac{1}{3}$	$3\frac{2}{3}$	.	11	$\frac{1}{3}$	$2\frac{1}{3}$	.	$1\frac{2}{3}$	2	....	.	.....	....	.	1351
...	....	....	..	.....	.	.	.	.	.	.	$3\frac{1}{3}$	1	1	$\frac{2}{3}$	6	5	2	$7\frac{2}{3}$	$4\frac{1}{3}$	.	.	.	....	.	.. .	....	.	1347
2	9	....	..	2.076	$\frac{1}{3}$	.	.	.	.	.	2	.	$1\frac{1}{3}$	.	$2\frac{2}{3}$	$\frac{1}{3}$	8	1	.	.	$9\frac{1}{3}$	6	....	.	.....	....	.	1363
8	7	....	..	1.233	.	.	.	.	.	.	.	.	$2\frac{1}{3}$	.	$11\frac{2}{3}$	.	$8\frac{1}{3}$	.	.	.	$8\frac{2}{3}$	.	....	.	...	....	.	1354
...	....	....	..	.....	$2\frac{2}{3}$	.	$\frac{2}{3}$	.	$\frac{2}{3}$	.	$4\frac{2}{3}$	.	$4\frac{1}{3}$	.	$7\frac{1}{3}$	.	$5\frac{1}{3}$	.	2	.	$1\frac{2}{3}$	$1\frac{2}{3}$	....	.	.....	....	.	1360
3	2	....	..	2.017	.	.	.	.	.	.	15	.	.	.	$1\frac{1}{3}$	.	.	.	$13\frac{2}{3}$	.	.	1	....	.	.....	....	.	1359
	6	....	..	5.833	.	.	1	.	.	.	$6\frac{1}{3}$	.	$\frac{1}{3}$	.	10	.	$5\frac{1}{3}$	.	$5\frac{2}{3}$	.	$2\frac{1}{3}$	.	....	.	.....	....	.	1442
8	2	3	..	3.935	.	.	2	$\frac{2}{3}$	$1\frac{1}{3}$	$\frac{2}{3}$	4	.	$\frac{2}{3}$	$\frac{1}{3}$	2	.	$3\frac{2}{3}$	1	$4\frac{1}{3}$	1	$5\frac{2}{3}$	$3\frac{2}{3}$	....	.	.....	....	.	1358
4	5	1	..	.....	$\frac{1}{3}$	.	$\frac{1}{3}$	.	.	.	$5\frac{1}{3}$	.	$\frac{1}{3}$	.	$7\frac{2}{3}$	.	.	.	$14\frac{1}{3}$	.	2	$\frac{2}{3}$	....	.	.....	....	.	1380
3	8	....	..	4.254	.	.	1	.	$10\frac{1}{3}$	.	$1\frac{1}{3}$	.	$\frac{1}{3}$	.	$11\frac{2}{3}$	.	$5\frac{2}{3}$	.	$\frac{2}{3}$	.	.	.	....	.	.....	....	.	1349